APPENDIX B
STANFORD'S FINAL HABITAT CONSERVATION PLAN

STANFORD UNIVERSITY
HABITAT CONSERVATION PLAN

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HABITAT CONSERVATION PLAN

Prepared by:
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SECTION 1
INTRODUCTION

1.0 INTRODUCTION

A Habitat Conservation Plan (HCP) is part of a process outlined by Section 10 of the federal Endangered Species Act (ESA) that involves cooperation between the federal government and a private landowner. The ESA prohibits landowners from taking a wildlife species that is listed as threatened or endangered. "Taking" includes directly killing an individual of a wildlife species or, in some circumstances, destroying its habitat. Under Section 10, the U.S. Fish and Wildlife Service (Service) and the National Oceanic and Atmospheric Administration (NOAA Fisheries) can authorize the taking of listed species that is incidental to an otherwise lawful activity, if the landowner first prepares and agrees to implement an acceptable HCP. This authority is discussed in more detail in Section 1.2, below. The purpose of this HCP is to describe Stanford's activities and identify measures that will minimize and mitigate the effects of these activities on species.

Stanford University owns more than 8,000 contiguous acres of land on the San Francisco Peninsula. Stanford's activities, such as construction of new facilities and certain activities performed to keep the University functioning, have been ongoing for more than 100 years, and could result in the incidental taking of species presently listed as threatened or endangered under the federal ESA, or species that could become listed in the future. As a result, Stanford desires to obtain incidental take authorization. Stanford also desires to conduct long-term land use and academic planning, and implement conservation actions on its land. All of these desires will be served by this HCP, which will result in a long-term (50-year) incidental take permit from the Service and NOAA Fisheries, and provide long-term certainty for Stanford's planning and land management efforts.

The particular species covered by this HCP are identified in Section 1.3 and described in Section 2.4, and the permitted activities are described in Section 3.0. Section 4.0 of this HCP describes the specific conservation commitments, which include take avoidance measures and specific habitat enhancement measures. The requirements for issuing an incidental take permit are discussed in more detail in Section 6.0. Other portions of this document provide additional information about the University and pertinent information about the various species and their habitat.

1.1 STANFORD UNIVERSITY - A UNIQUE LANDOWNER

1.1.1 History and the Founding Grant

In 1876, former California Governor Leland Stanford purchased 650 acres of Rancho San Francisquito for a country home and began the development of his famous Palo Alto Stock Farm for trotting horses. He later bought adjoining properties and the farm grew to 6,400 acres. This land eventually became the main Stanford campus.

Upon the death of Leland Stanford Junior in 1884, Governor and Mrs. Stanford decided that founding a university would be a fitting memorial to their son. In November 1885, the Stanfords created a "Founding Grant" for the University. This document provides the original endowment for the University and, to this day, governs the University's objectives, organization and responsibilities. Under the Founding Grant, the objectives of the University are:

> *"to qualify students for personal success and direct usefulness in life; and to promote the public welfare by exercising an influence on behalf of humanity and civilization, teaching the blessings of liberty regulated by law, and inculcating love and reverence for the great principles of government as derived from the inalienable rights of man to life, liberty, and the pursuit of happiness."*

The Founding Grant forbids the sale of any of the lands the Stanfords donated to the University, and ensures the University will be a permanent academic institution. The original endowment of 6,400 acres was intended to provide for the University's original and future academic objectives. In an address to the University's first Board of Trustees, then Senator Stanford explained the reasons for prohibiting the sale of any land donated by the Stanfords:

> *"The endowment of lands is made because they are, in themselves, of great value, and their proper management will insure to the University an income much greater than would be realized were their value to be invested in any reliable, interest-bearing security."*

The land endowment was intended to support the University by providing land for academic uses and for other uses that would produce a steady stream of income and subsidize the costs of higher education. During their lifetimes, the Stanfords leased portions of the University lands so they could focus their attention on building the University. In addition to income from these leases, the University was relieved of the substantial burdens of routine maintenance on the 5,000 acres of leased property. The need to generate income in support of the University's educational mission and to maintain the land reserve remains an important element of land use planning outside of the academic campus area.

The Stanfords consulted with many of the era's leading academics and architects, and hired Frederick Law Olmsted (the landscape architect who designed New York's Central Park) and Charles Allerton Coolidge to design the University. Olmsted originally suggested building the main campus in the foothills, but the Stanfords decided to construct the University on the relatively flat alluvial plain. On May 14, 1887 (Leland Jr.'s birthday), the cornerstone of the University was laid, and on October 1, 1891, Stanford University opened its doors to students.

1.1.2 Site Description

Stanford University owns 8,180 acres of land in northern Santa Clara County and southern San Mateo County along the southeastern base of the San Francisco Peninsula (Figure 1-1). The University is located in two counties (Santa Clara and San Mateo), two cities (Palo Alto and Menlo Park), and two towns (Woodside and Portola Valley) (Figure 1-2).

The University is located in two main watersheds: Matadero/Deer Creek and San Francisquito Creek. The San Francisquito Creek watershed includes San Francisquito, Los Trancos, Corte Madera, Bear, Dennis Martin, Sausal, and Alambique creeks.

1.1.3 Land Use at Stanford University

The University is developed with various land uses (Figure 1-3), and all of the lands owned by Stanford are an integral part of the University's academic fabric. Most of the urban facilities, including academic buildings, student and faculty housing, roads, sidewalks, bicycle paths, and recreational facilities such as playing fields, equestrian facilities, a golf course, and a golf driving range, are located in the central part of the campus, roughly bounded by Junipero Serra Boulevard, El Camino Real, Stanford Avenue and Sand Hill Road. There is an Academic Reserve outside this core academic area that is generally undeveloped or vacant and used for low intensity academic uses, such as the radio astronomy program. Some of Stanford's lands are leased for interim non-academic purposes, which provide funds for University operations. Stanford also maintains three open-water reservoirs: Lagunita, Felt, and Searsville (Figure 1-3).

In addition to the need to maintain use of its land for future academic uses, the University's lands have always been used as outdoor laboratories for teaching and research in biology, archaeology, geology and engineering. Jasper Ridge Biological Preserve and the Archaeological Preserve along San Francisquito Creek are examples of the University's commitment to this type of academic land use.

The University's rich array of native biological communities, including redwood forest, riparian forest, chaparral, oak woodland-savanna, and serpentine grassland, has contributed to its academic success. These natural resources provide an essential link between laboratory activities, teaching, research, and field-based studies. In 1973, the Jasper Ridge Biological Preserve was formalized as a research facility. Jasper Ridge Biological Preserve is 1,200 acres, which is larger than the entire core academic campus. Scientists and students have used the Preserve for decades as an outdoor laboratory and classroom, and continue to do so.

Throughout Stanford's history, undergraduates, graduate students, and faculty have spent significant amounts of time conducting studies utilizing local natural resources. In recent years, 2,000 to 2,500 Stanford students from 15 to 20 courses visit Jasper Ridge annually. As of 2009, there were more than 60 on-going research projects using data collected at Jasper Ridge. These projects were conducted by faculty, senior scientists, and students from Stanford University and other institutions. In addition to Jasper Ridge Biological Preserve, Stanford faculty, students and researchers have long-term research and teaching interests in San Francisquito Creek, Corte Madera Creek, Los Trancos Creek, Matadero Creek, and the University's oak woodland-savannas.

1.1.4 Operating Stanford University

Stanford University supports a daily population of approximately 30,000 people on its academic campus. Therefore, operating the University is akin to operating a mid-sized city that has land uses ranging from cattle grazing to high tech research and development, and includes medical and other public service facilities. To accommodate the variety of land uses at Stanford, the University operates and maintains a number of utilities, roadways, flood control improvements, water diversion and delivery facilities, and other urban improvements.

Stanford has been operating many of its facilities since the University's inception nearly 120 years ago, and, as a permanent academic institution, it will continue to operate for the indefinite future. This includes permanent water diversion and delivery facilities, and flood control improvements. Some of Stanford's facilities and day-to-day operations, such as Searsville Dam which was built in 1892, have changed very little since Stanford open its doors. Other facilities and day-to-day activities have evolved or been expanded over time to reflect new technology, respond to environmental concerns, or accommodate an expanding population. As such, Stanford has more than 100 years of hindsight in operating the University, which provides a sound basis for identifying its future operations and need for new improvements.


NAPA COUNTY
SONOMA COUNTY
SOLANO COUNTY
MARIN COUNTY
Sausalito
BERKELEY
CONTRA COSTA COUNTY
OAKLAND
SAN FRANCISCO CO.
SAN FRANCISCO
Pacific Ocean
Hayward
Pleasanton
Pacifica
San Francisco Bay
ALAMEDA COUNTY
San Mateo
Newark
Half Moon Bay
STANFORD UNIVERSITY
Palo Alto
SAN JOSE
Sunnyvale
La Honda
San Gregorio
SAN MATEO COUNTY
SANTA CLARA COUNTY
NOT TO SCALE
Stanford University Planning Office
Data Printed: December 2011
(Aerial Photo Source: PG&E, USGS, 2004)
Figure 1-1

1.2 REGULATORY CONTEXT

1.2.1 Federal Endangered Species Act

The ESA creates a process for identifying species needing protection, provides a framework for determining the type of protective measures needed, and provides for enforcement measures. Two sections of the ESA are most relevant to Stanford:

- Section 9 (16 USC 1538) prohibits the taking of wildlife species listed as threatened or endangered; and
- Section 10 (16 USC 1539) provides for the issuance to non-federal entities of a permit authorizing the incidental take of listed wildlife species.

Section 9 of the ESA prohibits the take of wildlife species listed as endangered, and it prohibits the take of species listed as threatened unless otherwise specifically authorized by regulation. "Take" is broadly defined to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." "Harm" has been defined to mean an act which actually kills or injures wildlife, including those activities that cause significant habitat modification or degradation resulting in the killing or injuring of wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering. (50 CFR 17.3; 50 CFR 222).

Section 10 of the ESA allows for the incidental take of endangered and threatened species by non-federal entities. The ESA defines "incidental take" as take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." Parties that are responsible for incidental take of listed species must do so under the authorization of an incidental take permit issued by the Service or NOAA Fisheries.

To obtain an incidental take permit under Section 10 of the ESA, an applicant must prepare a Habitat Conservation Plan that provides the following information:

- Impacts likely to result from the proposed taking of the species for which permit coverage is requested;
- Measures the applicant will undertake to monitor, minimize, and mitigate such impacts;
- Funding the applicant or other known sources will make available to undertake these measures and the procedures that will be followed in dealing with changed and unforeseen circumstances;
- Alternative actions the applicant considered that would not result in take, and the reasons why it is not proposing these alternatives; and
- Additional measures that the Service or NOAA Fisheries may require as necessary or appropriate for purposes of the plan. [1]

1.2.2 National Environmental Policy Act (NEPA)

Congress enacted the National Environmental Policy Act (NEPA) in 1969 to ensure that federal agencies consider the environmental impacts of their actions and decisions. NEPA requires the federal government to use all practicable means and measures to protect environmental values and makes environmental protection a part of the mandate of every federal agency and department. NEPA requires analysis and a detailed statement of the environmental impact of any proposed federal action that significantly affects the quality of the human environment. With respect to this HCP, the Service and NOAA Fisheries will analyze the potential environmental effects related to the issuance of a Section 10 incidental take permit consistent with NEPA requirements. The NEPA analysis will address the direct, indirect, and cumulative effects.

1.2.3 Five-Point Policy Guidance

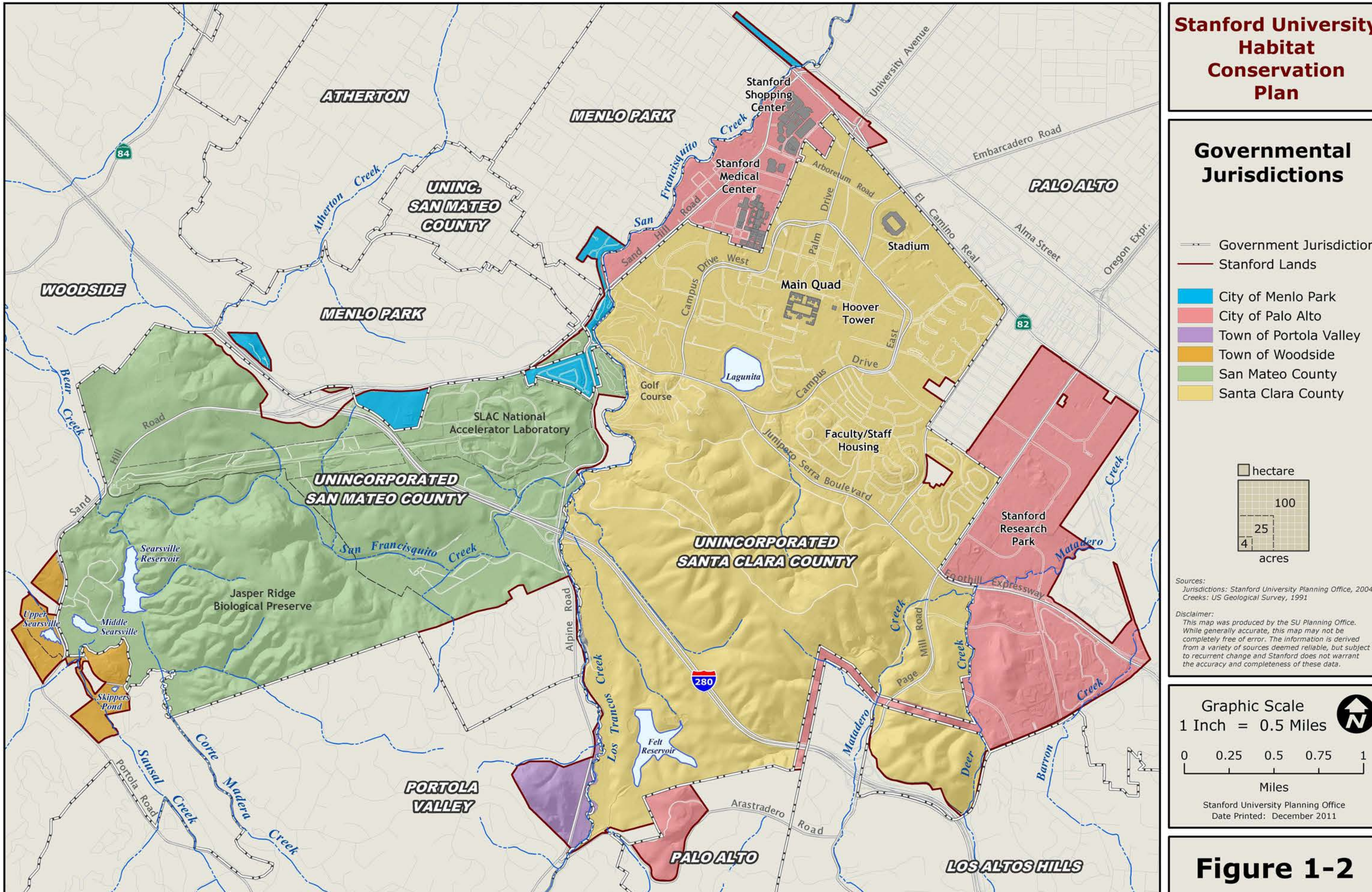
In 2000, the Service and NOAA Fisheries adopted a five-point policy initiative designed to clarify elements of the HCP program as they relate to measurable biological goals, adaptive management, monitoring, permit duration, and public participation. The following summarizes these five points.

Biological Goals and Objectives: HCPs must include biological goals and objectives that set out specific measurable targets that the plan is intended to meet. These targets are based on the best scientific information available and are used to guide conservation strategies for species covered by the plan.

Adaptive Management: The five-point policy encourages the development of adaptive management plans as part of the HCP process under certain circumstances. Adaptive management provides a means to address biological uncertainty and to devise alternative strategies for meeting biological goals and objectives.

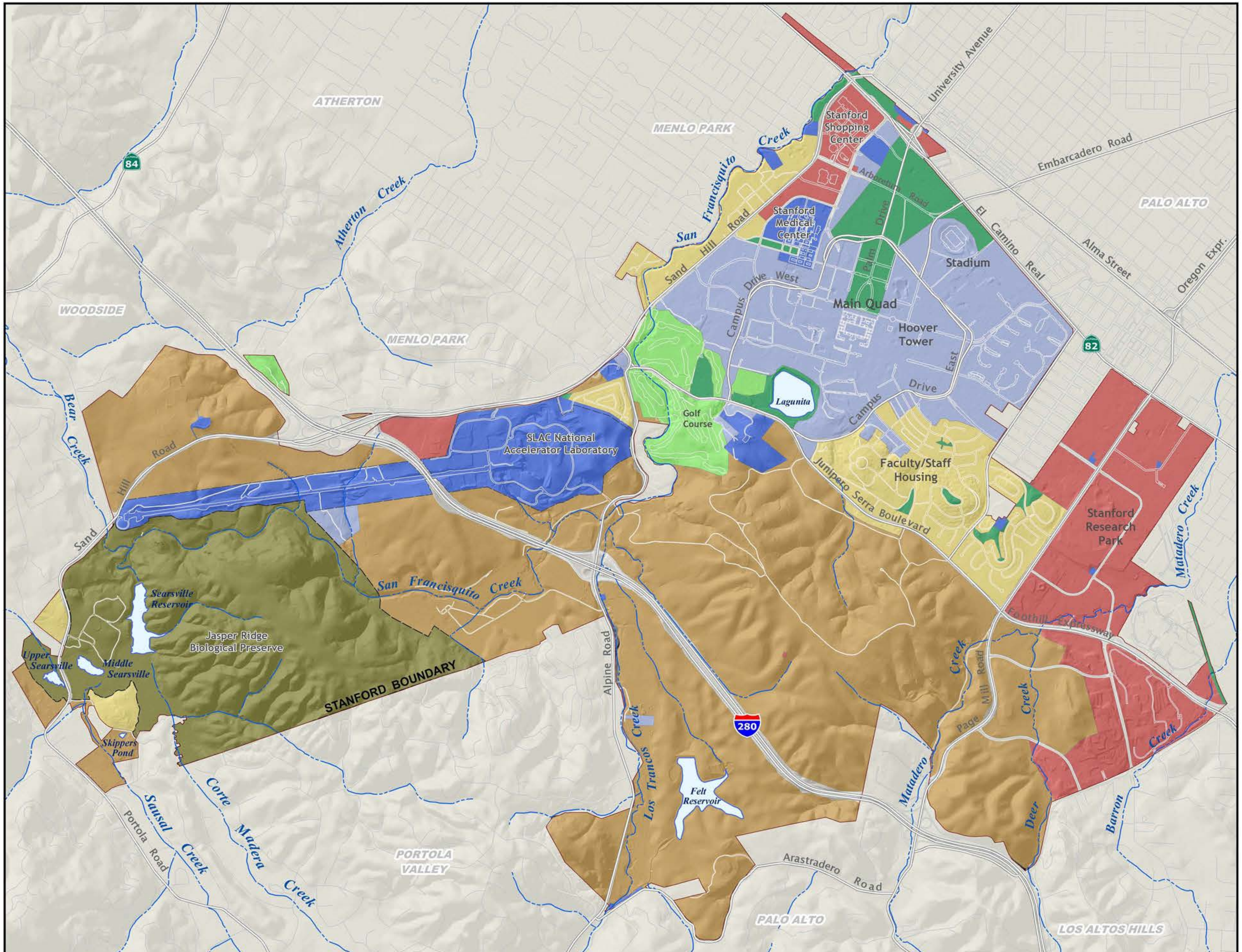
Monitoring: Monitoring is a mandatory element of all HCPs under the five-point policy. As such, an HCP must provide for monitoring programs to gauge the effectiveness of the plan in meeting the biological goals and objectives and to verify that the terms and conditions of the plan are being properly implemented.

[1] *The Habitat Conservation Planning and Incidental Take Permit Processing Handbook*, published by the Service and NOAA Fisheries (formerly called the National Marine Fisheries Service or NMFS) in November 1996, provides additional guidance concerning the preparation and content of habitat conservation plans. The Service and NMFS published a final addendum to the *HCP Handbook* on June 1, 2000 (65 FR 35242). This addendum, also known as the Five-Point Policy guidance, provides clarifying guidance for the two agencies in conducting the incidental take permit program and for those applying for an incidental take permit under Section 10(a)(1)(B) of the ESA. The five components addressed in the policy are: (1) biological goals, (2) adaptive management, (3) monitoring, (4) permit duration, and (5) public participation. These components are discussed in Section 1.2.3.



Stanford University Habitat Conservation Plan
Governmental Jurisdictions
Government Jurisdiction
Stanford Lands
City of Menlo Park
City of Palo Alto
Town of Portola Valley
Town of Woodside
San Mateo County
Santa Clara County
hectare
100
25
4
acres
Sources:
Jurisdictions: Stanford University Planning Office, 2004
Creeks: US Geological Survey, 1991
Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.
Graphic Scale
1 Inch = 0.5 Miles
N
0
0.25
0.5
0.75
1
Miles
Stanford University Planning Office
Date Printed: December 2011
ATHERTON
MENLO PARK
UNINC. SAN MATEO COUNTY
WOODSIDE
MENLO PARK
PALO ALTO
UNINCORPORATED SAN MATEO COUNTY
UNINCORPORATED SANTA CLARA COUNTY
PORTOLA VALLEY
PALO ALTO
LOS ALTOS HILLS
Stanford Shopping Center
Stanford Medical Center
Stadium
Main Quad
Hoover Tower
Lagunita
Golf Course
SLAC National Accelerator Laboratory
Faculty/Staff Housing
Stanford Research Park
Jasper Ridge Biological Preserve
Searsville Reservoir
Upper Searsville
Middle Searsville
Skippers Pond
Felt Reservoir
San Francisquito Creek
Atherton Creek
Bear Creek
Sausal Creek
Corte Madera Creek
Los Trancos Creek
Matadero Creek
Deer Creek
Barron Creek
Sand Hill Road
Campus Drive West
Campus Drive East
Palm Drive
Arboretum Road
Junipero Serra Boulevard
El Camino Real
Alma Street
Oregon Expr.
Embarcadero Road
University Avenue
Foothill Expressway
Page Mill Road
Arastradero Road
Alpine Road
Portola Road
84
82
280

Figure 1-2



Stanford University Habitat Conservation Plan

Land Use

- Academic
- Academic Reserve
- Biological Preserve
- Commercial
- Institutional
- Open Space
- Recreation
- Residential

hectare
100
25
4
acres

Sources:
Land Use: Stanford University Planning Office, 2006
Creeks: US Geological Survey, 1991

Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 0.5 Miles
0 0.25 0.5 0.75 1
Miles

N

Stanford University Planning Office
Date Printed: December 2011

Figure 1-3

Permit Duration: Under the five-point policy, several factors are used to determine the duration of an incidental take permit, including the duration of the applicant's proposed activities and the expected positive and negative effects on covered species associated with the proposed duration. The agencies also consider the level of scientific and commercial data underlying the proposed operating conservation program, the length of time necessary to implement and achieve the benefits of the operating conservation program, and the extent to which the program incorporates adaptive management strategies.

Public Participation: Under the five-point policy guidance, the agencies announced their intent to expand public participation in the HCP process to provide greater opportunity for the public to assess, review, and analyze HCPs and associated documentation (e.g., NEPA review). As part of this effort, the public review process for most HCPs was expanded from a 30-day comment period to a 60-day period.

1.3 COVERED SPECIES

Covered Species are the species addressed by this HCP and covered by the resulting incidental take permits. Stanford's intent is to provide conservation and acquire incidental take permit coverage for several species listed under the ESA, and for an additional species that could be listed during the term of the incidental take permits. Stanford has requested an incidental take permit from both NOAA Fisheries and the Service to cover incidental take of the following species, which are each discussed in detail in Section 2.4:

- California red-legged frog (Rana aurora draytonii)
- Central California Coast Evolutionary Significant Unit steelhead (Oncorhynchus mykiss)
- California tiger salamander (Ambystoma californiense)
- Western pond turtle (Clemmys marmorata)
- San Francisco garter snake (Thamnophis sirtalis tetrataenia)

Several of the Covered Species have the same general habitat requirements. However, the precise habitat needs for each of the species vary. For example, all five of the Covered Species use aquatic habitats. Steelhead require relatively cool and clean flowing water, and creeks that permit barrier-free passage. Red-legged frogs, pond turtles, and tiger salamanders both need pools or slow-moving water for breeding and adjacent upland areas for foraging and dispersal. Garter snakes are found in a wide range of environments, but are typically associated with pond or creeks with surrounding vegetation. The general habitat needs of each of the Covered Species are summarized in Table 1-1, and they are described in detail in Section 2.4.

1.4 COVERED ACTIVITIES

Covered Activities are those activities for which incidental take is permitted under an incidental take permit. Stanford is an academic institution that engages in a variety of activities, some of which could present a risk to one or more of the Covered Species. The following categories of activities are addressed by this HCP and will be covered by the resulting incidental take permit:

- Ongoing operations of the University, including maintaining, renewing and necessary development of the campus (e.g., landscape; facility maintenance; civil, energy, and communications infrastructure; fire suppression),
- Academic activities as mandated by the Founding Grant of the University,
- Operation and maintenance of water supplies and water supply facilities,
- Recreational activities, and
- Future development associated with the Santa Clara County 2000 General Use Permit and other development which may occur under future permits from Santa Clara and San Mateo counties and the cities and towns of Palo Alto, Menlo Park, Woodside, and Portola Valley.

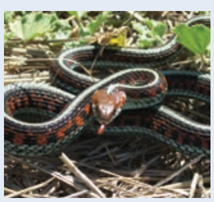
In addition, the incidental take permit will cover activities carried out by Stanford lessees under Certificates of Inclusion. These activities include:

- Equestrian facilities
- Agricultural activities
- Commercial and institutional activities
- Operation of civil, energy, and communications infrastructure

As discussed in Section 3.1, the HCP does not cover Searsville facilities or operations, or any modifications to Searsville. Any modifications are currently speculative and any future changes could be covered by an amendment to the HCP or through a separate permit under Section 7 of the Endangered Species Act.

The HCP also does not cover biocide use, although it does provide minimization measures for biocide use.

Table 1-1 General Habitat Needs of the Covered Species

SPECIES		SUMMARY OF HABITAT NEEDS
California red-legged frog (CRLF)		Permanent bodies of slow-moving or standing water, with sufficient vegetation to provide cover and support ample prey, and with areas that are at least 3 feet in depth; adjacent upland areas of suitable vegetation to allow for dispersal and to seasonally support non-breeding individuals.
Steelhead (SH)		Streams and creeks with relatively cool and clean water, low sediment gravel beds for spawning sites, pools, riffles, and runs for rearing habitat, riparian vegetation to help cool the water and to support high levels of prey, unimpeded upstream and downstream dispersal routes.
California tiger salamander (CTS)		Seasonal ponds that fill in December or January and hold water until June, with sufficient levels of aquatic prey and cover to allow for larval development and metamorphosis; adjacent upland areas that provide sufficient densities of rodent burrows or debris for California tiger salamander to inhabit during the non-reproductive period, and vegetation appropriate for California tiger salamander residency and migration.
Western pond turtle (WPT)		Permanent bodies of slow-moving or standing water, with sufficient vegetation to provide cover and support ample quantities of food; adjacent upland areas of suitable substrate and vegetation as to provide nesting locations and wet season refugia.
San Francisco garter snake (SFGS)		Permanent or nearly permanent bodies of water, usually with areas of shallow water and heavily vegetated shores; however, they are known to occur, at least temporarily, in grassland, riparian woodland, oak woodland, and coniferous forest.

1.5 HCP GOALS

1.5.1 Stanford's Institutional Goals

Stanford's primary mission is teaching and research. Proper stewardship of Stanford's lands has been, and will continue to be, essential to the success of the University. Since opening in 1891, Stanford has endeavored to provide a top-ranked academic experience for all eligible students, regardless of their financial resources. The academic curriculum, depth and kinds of research, and how students are taught have all progressed remarkably since the University opened. This continuous progress makes it difficult to predict the needs of future students and faculty members. For these reasons, and because of legal restrictions associated with the Founding Grant that established the University, retaining future land use flexibility is vital to the University's long-term academic success.

During the academic year, thousands of people live on campus, and hundreds more visit the University each day. The University's size and infrastructure, which includes laboratories, offices, hospitals, student centers, athletic facilities, housing, roads, landscape and other urban facilities, are similar to a city of 30,000 people. Currently, Stanford provides housing for 95 percent of the 6,500 undergraduate students that attend the University and approximately 60 percent of its 6,500 graduate students. The University also houses nearly 900 faculty members.

Stanford has developed a set of Institutional Goals that reflect the University's core academic mission and the realities of day-to-day operation of the University. These goals, in concert with Stanford's Biological Goals, will be used to evaluate future activities that are governed by this HCP.

In the context of this HCP, Stanford's Institutional Goals are as follows:

Institutional Goal #1: Maintain land use flexibility.

Institutional Goal #2: Maintain and enhance biological resources (i.e., native biodiversity) on University lands so that these resources can be utilized by future generations of students and faculty researchers.

Institutional Goal #3: Prepare a conservation program that incorporates sustainable land use planning policies and practices.

Institutional Goal #4: Implement cost effective conservation measures that efficiently invest the University's assets.

Institutional Goal #5: Define the University's legal responsibilities toward biological resources so that the University can develop its lands and operate in an environmentally and fiscally responsible manner during the next 50 years.

Institutional Goal #6: Utilize Stanford's water resources for the benefit of the University's research, educational, and operational activities, to the full extent of its water rights.

1.5.2 Stanford's Biological Goals and Objectives

Stanford University, like most of the San Francisco Peninsula, has urbanized over the past several decades. This regional urbanization likely will continue and has placed considerable stress on the area's natural resources. Stanford's Institutional Goals recognize the need to utilize the University's land and water resources, and the Biological Goals seek to protect and enhance Stanford's natural resources.

The Biological Goals described below implement the Five Points Policy, which states, "the best HCPs clearly define the desired outcome for the covered species and their habitats in terms of biological goals and objectives." In this HCP, Stanford has developed broad Biological Goals, as well as more specific "Biological Objectives" that provide measurable ways of determining whether a goal is being met. These goals and objectives provided the framework for developing an integrated conservation program that identifies specific management and minimization actions. These actions are intended to meet the Biological Goals and Objectives during the life of the HCP. The Biological Goals and Objectives also provide the Service and NOAA Fisheries with a benchmark for evaluating the likelihood the conservation program will be successful.

The Biological Goals of this HCP are:

Biological Goal #1: Maintain and enhance natural communities so that they benefit the Covered Species.

Biological Goal #2: Stabilize the local California tiger salamander population and increase its chance of long-term persistence at Stanford.

Biological Goal #3: Maintain ponds to promote California tiger salamander reproduction in the Foothills.

Biological Goal #4: Increase the local California red-legged frog population and increase its chance of long-term persistence at Stanford.

Biological Goal #5: Maintain or improve hydrologic and terrestrial conditions that presently support steelhead and increase the chance of long-term persistence for the local steelhead population.

Biological Goal #6: Maintain and improve habitat for western pond turtle to increase its chance of long-term persistence at Stanford.

Biological Goal #7: Maintain or improve habitat that could support the San Francisco garter snake and continue to contribute to the body of information about garter snakes at Stanford.

The goals and objectives are provided in Table 1-2.

1.6 SUMMARY OF STANFORD HCP APPROACH

Stanford's land use policies recognize the University's responsibility and commitment to respect the University's lands. A key focus of the HCP will be on species protected by the federal Endangered Species Act, including those species projected to receive protection during the life of the HCP, and their habitats that exist on Stanford lands. The incidental take of California red-legged frog, California tiger salamander, steelhead, western pond turtle, and San Francisco garter snake by ongoing and future Stanford University activities is projected to be small.

Stanford seeks a 50-year incidental take permit from the Service and NOAA Fisheries. The strategy employed by the HCP will begin benefiting the Covered Species as soon as the HCP is approved, and will continue to benefit the Covered Species throughout the life of the HCP. Stanford will over-mitigate projected impacts to Covered Species in the early years to maintain land use flexibility throughout the permit term. This will be achieved by establishing a pay-up-front conservation program. Many HCPs, such as one designed for a single development project, authorize incidental take early in the project period while spreading out mitigation throughout the project. In the Stanford HCP, Stanford has the opportunity to immediately contribute to the Covered Species through early preservation of existing habitat and creating new habitat. The pay-up-front approach means that early habitat conservation measures will compensate for or exceed any take associated with the HCP and ensure adequate species conservation throughout the life of the incidental take permit.

Table 1-2 Biological Goals and Objectives

Goal #1. Maintain and enhance natural communities so that they benefit the Covered Species.
Objective 1.1. Protect 13 contiguous miles of riparian vegetation and creek along San Francisquito Creek (7 miles), Los Trancos Creek (2.5 miles), Matadero Creek (2 miles), and Deer Creek (1.5 miles).
Objective 1.2. Protect no less than 350 acres along San Francisquito and Los Trancos creeks, and Matadero and Deer creeks within 1 year of issuance of an incidental take permit by the Service and NOAA Fisheries. Width of easement should range between 75 feet and 600 feet, averaging approximately 225 feet. Dedication of conservation easements that permanently protect high-quality habitat from urban encroachment should allow the populations to increase naturally, and prevent mortalities associated with urban land uses.
Objective 1.3. Implement site-specific management and monitoring plans for each permanent riparian conservation easement area that would prohibit new structures, monitor water quality, support revegetation and restoration activities, survey for Covered and non-native species, and control non-native species.
Objective 1.4. Protect 300 acres of grassland and seasonal ponds by establishing a no-build zone south of Junipero Serra Boulevard.
Objective 1.5. Implement a site-specific management and monitoring plan for the protected land to survey for Covered and non-native species, limit recreational activities, and provide vegetation management.
Objective 1.6. Move temporary structures and roads to areas more than 150 feet from the top of the creek bank, and revegetate vacated areas. Relocate 5,000 feet of road further from the creek within 3 years of issuance of an incidental take permit by the Service and NOAA Fisheries.
Objective 1.7. Restore 50 acres of riparian habitat and adjacent upland habitat.
Goal #2: California tiger salamander: Stabilize the local California tiger salamander population and increase its chance of long-term persistence at Stanford.
Objective 2.1. Protect, enhance, and expand prime habitat for the California tiger salamander, including both upland and aquatic habitat, in areas relatively distant from existing population sinks, by setting aside and prohibiting development for 50 years on no less than 300 acres in the foothills south of Junipero Serra Boulevard within 1 year of issuance of an incidental take permit by the Service and NOAA Fisheries.
Objective 2.2. When California tiger salamander habitat in less desirable areas is permanently impacted, permanently protect habitat for California tiger salamander through the dedication of permanent conservation easements within the 300 acres.

Goal #2 (continued)

Objective 2.3. Eliminate or reduce non-native plant and animal species that are impairing California tiger salamander reproduction or survival.

Objective 2.4. Facilitate California tiger salamander movement between developed areas that provide at least some marginal habitat and protected high-quality California tiger salamander habitat by maintaining at least three amphibian tunnels across Junipero Serra Boulevard.

Objective 2.5. Continue to supply water to Lagunita to allow metamorphosis of larval CTS.

Goal #3: California tiger salamander ponds: Maintain ponds to promote California tiger salamander reproduction in the Foothills.

Objective 3.1. Reduce the California tiger salamanders' reliance on Lagunita by constructing and maintaining a complex of a minimum of 10 seasonal ponds in the foothills to provide additional breeding location opportunities, and achieve California tiger salamander reproductive success in no less than 75% of the ponds.

Objective 3.2. Provide an appropriate environment for CTS, including an appropriate pH, a minimum depth of 12 inches, and an adequate invertebrate food source while CTS and larvae are present.

Objective 3.3. Within the first 3 years, construct five additional cover piles within 150 feet of the existing ponds to promote occupancy of the area by ground squirrels.

Objective 3.4. Any new ponds will have a minimum of three cover piles associated with them.

Objective 3.5. Manage grass height appropriate for ground squirrels and CTS around CTS ponds to an approximate distance of 500 feet from the ponds.

Objective 3.6. Modify or eliminate constructed ponds that the annual monitoring shows are not ponding during years of average or above average rainfall for a sufficient period of time to support California tiger salamander reproduction, or that are otherwise not adequately supporting tiger salamander reproduction.

Goal #4: California red-legged frog: Increase the local California red-legged frog population and increase its chance of long-term persistence at Stanford.

Objective 4.1. Protect riparian and adjacent upland areas for the benefit of California red-legged frog by dedicating conservation easements along San Francisquito and Los Trancos creeks and Matadero and Deer creeks that permanently protect no less than 350 acres of high-quality California red-legged frog habitat within 1 year of issuance of an incidental take permit by the Service and NOAA Fisheries.

Objective 4.2. Eliminate or reduce non-native species that are impairing California red-legged frog reproduction or survival.

Objective 4.3. Create additional areas suitable for California red-legged frog reproduction, including off-channel ponds and side channels, by designing and building a minimum of three breeding sites located off any of the main creek channels.

Goal #5: Steelhead: Maintain or improve hydrologic and terrestrial conditions that presently support steelhead and increase the chance of long-term persistence for the local steelhead population.

Objective 5.1. Protect riparian areas for the benefit of steelhead by dedicating a conservation easement over habitat along San Francisquito and Los Trancos creeks that permanently protects no less than 270 acres of high quality steelhead habitat within 1 year of issuance of an incidental take permit by the Service and NOAA Fisheries.

Goal #5 (continued)
Objective 5.2. Eliminate or reduce non-native species that are impairing steelhead spawning, rearing, or migration.
Objective 5.3. Repair and stabilize creek banks to remediate erosion and bank stabilization problems in order to prevent potentially intrusive emergency measures.
Objective 5.4. Remove undesirable items (trash, debris, etc.) from the creek channels.
Objective 5.5. Retain woody debris that does not pose a safety hazard in the creek channels.
Objective 5.6. Remove structures such as rip-rap, gabions, and in-stream structures that are adversely affecting steelhead migration, when feasible.
Objective 5.7. Restore more natural fish passage by removing the Lagunita Diversion facility.
Objective 5.8. Implement the Steelhead Habitat Enhancement Project by-pass flows.
Goal #6: Western pond turtle: Maintain and improve habitat for western pond turtle to increase its chance of long-term persistence at Stanford.
Objective 6.1. Protect riparian areas for the benefit of western pond turtles by dedicating a permanent conservation easement over habitat along San Francisquito and Los Trancos creeks that permanently protects no less than 270 acres of high-quality western pond turtle habitat within 1 year of issuance of an incidental take permit by the Service and NOAA Fisheries.
Objective 6.2. Eliminate or reduce non-native species that are impairing western pond turtle reproduction or survival.
Objective 6.3. Provide at least three basking platforms (natural or artificial) at Searsville and Felt reservoirs and Skippers Pond.
Objective 6.4. Provide or ensure the presence of at least three natural basking platforms in reaches of San Francisquito Creek that are occupied by turtles.
Goal #7: San Francisco garter snake: Maintain or improve habitat that could support the San Francisco garter snake and continue to contribute to the body of information about garter snakes at Stanford.
Objective 7.1. Protect riparian and adjacent upland areas for the benefit of San Francisco garter snake by dedicating conservation easements along San Francisquito and Los Trancos creeks and Matadero and Deer creeks that permanently protect no less than 350 acres of potential high quality San Francisco garter snake habitat within 1 year of issuance of an incidental take permit by the Service.
Objective 7.2. Continue to supply water to Lagunita to promote a prey base for San Francisco garter snake.
Objective 7.3. Eliminate or reduce non-native species that could impair San Francisco garter snake reproduction or survival.

SECTION 2
PHYSICAL/BIOLOGICAL SETTING, INCLUDING COVERED SPECIES

2.0 PHYSICAL / BIOLOGICAL SETTING, INCLUDING COVERED SPECIES

2.1 SIGNIFICANT HYDROLOGIC FEATURES

2.1.1 San Francisquito Creek Watershed

The San Francisquito Creek watershed encompasses an area of approximately 45 square miles and is located on the eastern flank of the Santa Cruz Mountains, at the base of the San Francisco Peninsula (Figure 2-1). This watershed is located in two counties, San Mateo and Santa Clara, and two of its constituent creeks (Los Trancos and San Francisquito) form part of the boundary between the two counties. The San Francisquito Creek watershed has four major sub-watersheds located at least partially on Stanford lands: Bear Creek (Bear Gulch Creek), Los Trancos Creek, San Francisquito Creek, and streams that flow into Searsville Reservoir (including Corte Madera, Dennis Martin, Sausal, and Alambique creeks).

A USGS gauging station (11164500) is located on San Francisquito Creek near the Stanford golf course, approximately 500 meters south (upstream) of the Junipero Serra Boulevard/Alpine Road intersection. This station has been in operation since the early 1930s.

The Stanford-owned mid-section of this watershed, including San Francisquito Creek between Searsville Reservoir and Junipero Serra Boulevard, Los Trancos Creek from Arastradero Road to its confluence with San Francisquito Creek at Piers Lane, and Bear Creek from Sand Hill Road to its confluence with San Francisquito Creek, are characterized by a mix of open space and development. This portion of the watershed includes low-density residential, commercial, recreational (e.g., Stanford golf course and equestrian facilities), scientific (e.g., SLAC National Accelerator Laboratory and Jasper Ridge Biological Reserve), and agricultural (e.g., Webb Ranch and Boething Treeland) land uses. Downstream from Junipero Serra Boulevard, the watershed is dominated by high-density residential and commercial land uses. Upstream from the Stanford-owned reaches, the watershed is mainly low-density residential and open space. Most of the creeks in the Stanford portion of the watershed support riparian vegetation, generally a 75- to 200-foot-wide band of dense willows, bay laurels, redwoods, alders, cottonwoods, dogwoods, valley oaks, and coast live oaks. This riparian zone is currently limited in extent by land use and topography.

The San Francisquito Creek watershed is a major source of water for Stanford. Flows within the creek are highly variable. In 1931, the USGS started recording flows within San Francisquito Creek. The mean annual flows have ranged from less that 0.05 cfs (recorded in 1961) to 89.1 cfs (recorded in 1933). During all but the wettest years, significant portions of San Francisquito Creek and its tributaries dry up by mid-summer.

When this HCP was prepared, Stanford had the following functioning water diversion facilities in the San Francisquito Creek system: Searsville Dam and Reservoir, located downstream from the confluence of Corte Madera Creek and Sausal Creek; Los Trancos diversion on Los Trancos Creek, near the intersection of Arastradero and Alpine roads; and an in-channel pumping station, located in San Francisquito Creek near the Stanford golf course, south of the Junipero Serra Boulevard/Alpine Road intersection. Another diversion facility called the Lagunita diversion dam facility, located on San Francisquito Creek approximately 4,300 feet south of Junipero Serra Boulevard, is currently not in service but has historically also served as a diversion facility to the campus. The diverted water is stored in Searsville Reservoir, Felt Reservoir, and Lagunita, or sometimes it is directly diverted for agricultural, University landscaping, and other uses.

Skippers Pond is the largest natural pond located on Stanford lands. It is situated in the riparian thicket adjacent to Family Farm Road, upstream from Jasper Ridge Biological Preserve, in San Mateo County. This pond fills naturally with groundwater and runoff, with comparatively little surface flow connection to the nearby creeks (Sausal and Corte Madera). Skippers Pond holds water year-round in some years, but generally dries up by the end of summer in years of average or below average rainfall.

A portion of the San Francisquito Creek watershed was listed in 1998 by the U.S. Environmental Protection Agency (EPA) as sediment and pesticide (diazinon) impaired. The EPA also listed Corte Madera Creek and the main stem of San Francisquito Creek as impaired. However, the water quality data from the Long Term Monitoring Program (a cooperative program sponsored by the San Francisquito Creek Watershed Council) in the San Francisquito Watershed consistently indicate absence of diazinon.

Hydrogeologic investigations of the groundwater in this area show the presence of thick coarse- and fine-grained alluvial deposits on the San Francisquito Creek alluvial fan where four of Stanford's groundwater wells are located (Sokol 1963, Geomatrix 1992). Geologic cross sections, based on the correlation of electrical resistivity logs, show that sand and gravel layers range between 50 and 200 feet in thickness, defining the most important groundwater zones. Several clay layers, interpreted to be mostly laterally continuous, range between 20 and 80 feet thick and form aquitards above and between the coarse water-bearing units. Stanford's wells are screened below the upper clays, starting at 100 feet below the surface.

2.1.2 Matadero Creek Watershed

The Matadero Creek watershed is entirely within Santa Clara County (Figure 2-1). Matadero Creek begins in Palo Alto's hills. The creek flows under Highway 280, through Stanford agricultural lands south of Foothill Expressway, and through the developed commercial and residential areas of the Stanford Research Park and Palo Alto. One major tributary, Deer Creek, joins Matadero Creek just upstream from Foothill Expressway.

Upstream from Foothill Expressway, Matadero and Deer creeks are generally low gradient, with broad riffle-run zones and pebble- to cobble-sized substrate. Both of the creeks in this area have reaches that dry out during drought conditions, but Deer Creek is much more ephemeral and susceptible to drying than the generally perennial Matadero Creek. The riparian zone is similar to that of San Francisquito Creek, consisting primarily of willow, bay, and oak trees, but is generally not as extensive (less wide) or mature.

Downstream of El Camino Real the creek has been channelized and concrete-lined for flood control by Santa Clara Valley Water District.

A mix of open space, low-density residential housing, and undeveloped private property covers the upland areas of the watershed. The downstream areas of the watershed have been highly modified and are either commercial or high-density residential.

A portion of the Matadero Creek watershed was listed in 1998 by the U.S. Environmental Protection Agency[1] as being pesticide (diazinon) impaired.

2.2 SIGNIFICANT LAND FORMS

2.2.1 Santa Cruz Mountains (Jasper Ridge)

A portion of the University is located on the lower, eastern flank of the Santa Cruz Mountains. The majority of this land form at Stanford is located in the Jasper Ridge Biological Preserve. The 1,200-acre Preserve is an academic research and teaching facility that is extensively used by students and researchers. The Preserve does provide significant conservation benefit to the region, but it is not operated as a refuge for native plants and animals. The Jasper Ridge Biological Preserve was designated as a research facility by the trustees of Stanford University. Public access is not allowed but docent-led tours are available.

Other land uses in this region include residential development, a vineyard, and equestrian facilities. Searsville Reservoir is located in the Jasper Ridge Biological Preserve and is managed by the University's Utilities Services in coordination with the Preserve.

2.2.2 Foothills

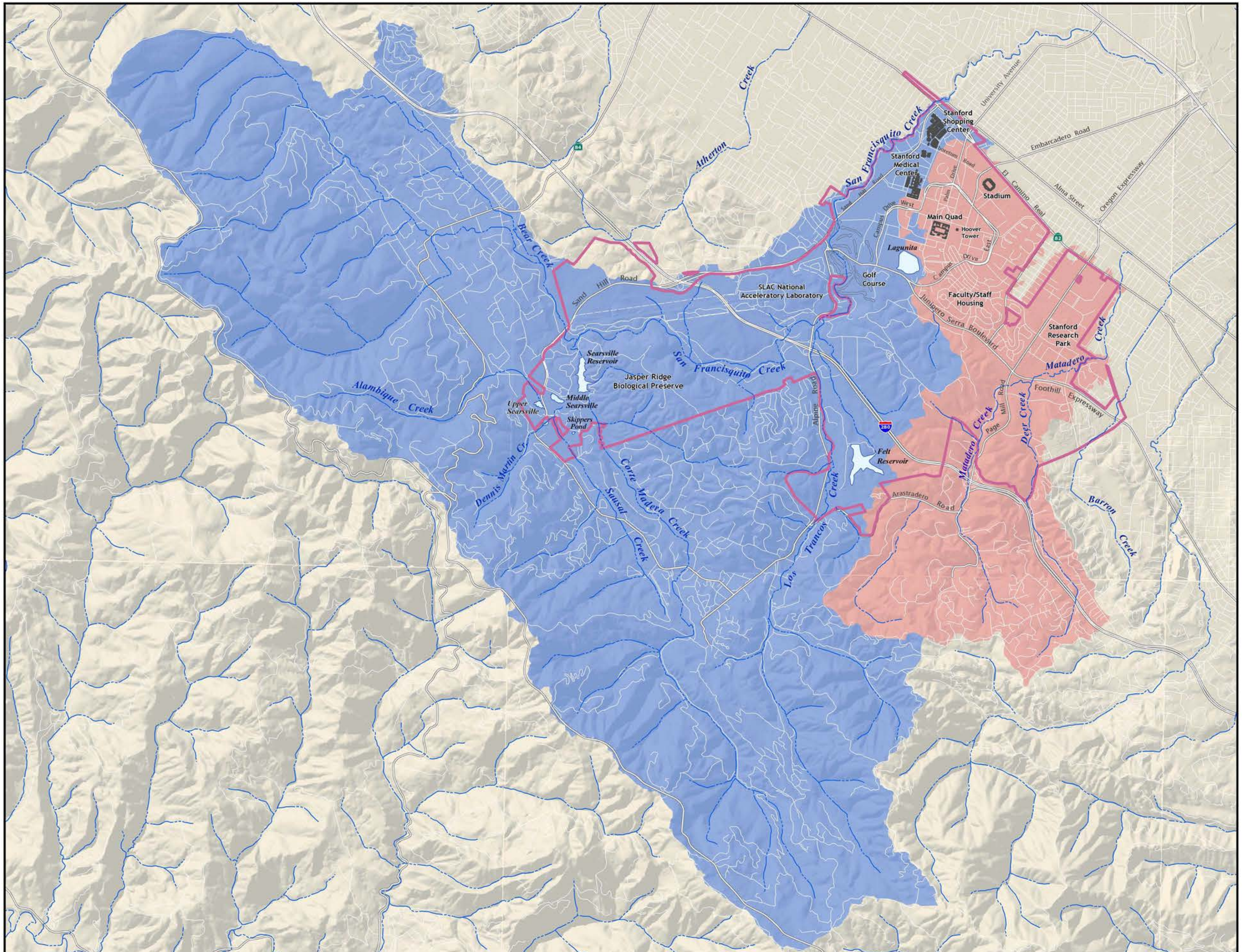
A wide-band of low, rolling foothills (generally 200 to 400 feet in elevation) are present from the edge of the main campus to the base of the Santa Cruz Mountains. The foothills are located south of Junipero Serra Boulevard and extend across Interstate 280 to Jasper Ridge. They consist of a mix of grassland, woodland, and riparian areas. The foothills are generally undeveloped, but do support a number of existing uses, primarily livestock grazing. A number of academic facilities are scattered across the foothills. These include radio telescopes, including the landmark Dish; a linear accelerator; solar observatory; student observatory complex; several academic think tanks; artist studio; and part of the Stanford golf course. Commercial communications facilities and four water supply-related facilities, including two enclosed reservoir tanks, are located in the Stanford foothills. Residential and commercial facilities also are located in the Stanford foothills.

Stanford allows public access to a limited portion of the foothills, but this recreational use is restricted to designated service roads. Formal public access points are located along Junipero Serra Boulevard and Alpine Road. Public use is monitored by Stanford University security, and dogs and bicycles are not allowed.

2.2.3 Alluvial Plain

Virtually all of the main campus is located on the comparatively flat areas located between the foothills and San Francisco Bay. Most of the alluvial plain area located north of Junipero Serra Boulevard/Foothill Expressway is developed with a relatively high density of housing, academic buildings, and commercial development. The alluvial plain areas south of Junipero Serra Boulevard are primarily agricultural, with crop plants farmed in areas near San Francisquito Creek, a commercial (wholesale) nursery that operates in several areas, and livestock (equestrian) uses scattered across most of the remaining areas. A few academic facilities are in these southern alluvial plain areas (e.g., a plant genetics laboratory and a plant growth facility).

[1] http://oaspub.epa.gov/tmdl/waters_list.tmdl_report?p_tmdl_id=32396



Stanford University Habitat Conservation Plan

Primary Watershed Basins

Matadero Creek
San Francisquito Creek
Stanford Boundary

Note:
Complete stream basins not shown. Depicted are those primary basin areas that are adjacent to, within or upstream of Stanford University lands.

Sources:
Watershed: USGS, 1991, Nolte, 1999, SU/PO, 2004
Additional S.F. Creek drainage: Nolte, 1999
Creeks: US Geological Survey, 1991

Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 1 Mile
0 0.5 1
Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 2-1

2.3 BIOLOGICAL SETTING

2.3.1 Annual Grassland

This community/habitat type consists primarily of non-native annual grasses and forbs forming a continuous cover of herbaceous vegetation. Annual grasslands are present in the alluvial plain and lower foothills portions of Stanford. Non-native species dominating these areas include ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), Italian rye (*Lolium multiflorum*), wild oat (*Avena fatua* and *A. barbata*), wall barley (*Hordeum murinum*), Italian thistle (*Carduus pycnocephalus*), storksbill (*Erodium species*), bristly ox-tongue (*Picris echioides*), purple star thistle (*Centaurea calcitrapa*), yellow star thistle (*Centaurea solstitialis*), common groundsel (*Senecio vulgaris*), geranium (*Geranium species*), and milk thistle (*Silybum marianum*). Several native grasses, most notably purple needlegrass (*Nassella pulchra*), are not uncommon in some areas of the grasslands at Stanford. Native forbs that commonly occur within this community include: California man-root (*Marah fabaceus*), California buttercup (*Ranunculus californicus*), blue-eyed grass (*Sisyrinchium bellum*), terrestrial brodiaea (*Brodiaea terrestris*), blue dicks (*Dichelostemma capitatum*), Ithuriel's spear (*Tritelia laxa*), suncup (*Oenothera ovata*), and mule's ear (*Wyethia species*). Occasional individual oak trees or small, open-canopied groupings of oaks occur within this community type.

Annual grasslands at Stanford provide habitat for a diversity of terrestrial wildlife. Amphibians include western toad (*Bufo boreas*), Pacific treefrog (*Hyla regilla*), and California tiger salamander (*Ambystoma californiense*). Reptiles include the western fence lizard (*Sceloporus occidentalis*), gopher snake (*Pituophis melanoleuca*), and western racer (*Coluber constrictor*).

A variety of bird species are at least seasonally present in the grasslands at Stanford. Avian seedeaters, including western meadowlark (*Sturnella neglecta*), nest in grazed annual grasslands, while other grassland species, such as red-winged blackbirds (*Agelaius phoeniceus*), are more likely to nest in taller, ungrazed vegetation. A variety of other species, including American goldfinch (*Carduelis tristis*), California towhee (*Pipilo crissalis*), loggerhead shrike (*Lanius ludovicianus*), and northern mockingbird (*Mimulus polyglottos*), nest in scattered shrubs throughout annual grasslands. Raptors, including white-tailed kite (*Elanus caeruleus*), red-tailed hawk (*Buteo jamaicensis*), barn owl (*Tyto alba*), and American kestrel (*Falco sparvarius*), nest in nearby trees and forage in grasslands. Burrowing owls (*Athene cunicularia*) have not been observed nesting at Stanford for nearly a century, but overwinter at several locations at Stanford. Aerial foragers, including northern rough-winged swallow (*Stelgidopteryx serripennis*), tree swallow (*Tachycineta bicolor*), violet-green swallow (*Tachycineta thalassina*), cliff swallow (*Petrochelidon pyrrhonota*), barn swallow (*Hirundo rustica*), and white-throated swift (*Aeronautes saxatilis*), also may frequent annual grasslands. Great blue herons (*Ardea herodias*) and great egrets (*Ardea alba*) frequently are observed foraging in the grasslands of Stanford.

Small mammals that forage on the plants found in this habitat type include deer mice (*Peromyscus species*), western harvest mouse (*Reithrodontomys megalotis*), California vole (*Microtus californicus*), California ground squirrel (*Spermophilus beecheyi*), and Botta's pocket gopher (*Thomomys bottae*). Larger mammals, such as bobcat (*Lynx rufus*), coyote (*Canis latrans*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), black-tailed jackrabbit (*Lepus californicus*), and black-tailed deer (*Odocoileus hemionus*), also use the annual grasslands at Stanford, though other habitats are generally required for cover. Badgers (*Taxidea taxus*) are apparently absent from Stanford and rarely sighted in the southern San Francisco Peninsula. Mountain lions (*Felis concolor*) are occasionally reported from the grasslands, riparian zones, and woodlands of the lower foothills region.

2.3.2 Oak Woodland/Savanna

This plant community occurs in a number of locations at Stanford. This community is dominated by a mix of coast live oaks (*Quercus agrifolia*), blue oaks (*Quercus douglasii*), valley oaks (*Quercus lobata*), and California buckeye (*Aesculus californica*). Understory species include shrubs such as poison oak (*Toxicodendron diversilobum*), toyon (*Heteromeles arbutifolia*), common snowberry (*Symphoricarpos albus*), blue elderberry (*Sambucus mexicana*), western leatherwood (*Dirca occidentalis*), and occasional dense patches of coyote brush (*Baccharis pilularis*) along the edges of the woodland. Common grass species and herbs found beneath the oak woodland canopy include ripgut brome, bedstraw (*Galium californicum*), wide-leaf filaree (*Erodium botrys*), soft chess, Italian rye, soft geranium (*Geranium dissectum*), Indian lettuce (*Claytonia parviflora*), and goldenback fern (*Pentagramma triangularis*).

The wildlife typically associated with oak woodland at Stanford include: bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), western gray squirrel (*Sciurus griseus*), California ground squirrel, black-tailed deer, deer mice, San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*), broad-footed mole (*Scapanus latimanus*), acorn woodpecker (*Melanerpes formicivorus*), band-tailed pigeon (*Columba fasciata*), northern flicker (*Colaptes aurantus*), and western scrub jay (*Aphelocoma californica*). Oak trees and other hardwoods in this community provide shelter, shade, and breeding habitat for mammal species such as raccoon, striped skunk, and cottontail rabbits (*Sylvilagus audubonii*).

The abundant insect and plant life present in the oak woodlands provides food for bird species such as white-breasted nuthatch (*Sitta carolinensis*), California thrasher (*Toxostoma redivivum*), bushtit (*Psaltriparus minimus*), oak titmouse (*Baeolophus inornatus*), dark-eyed junco (*Junco hyemalis*), blue-grey gnatcatcher (*Polioptila caeurlea*), Bewick's wren (*Thryomanes bewickii*), spotted towhee (*Pipilo maculatus*), California quail (*Callipepla californica*), mourning dove (*Zenaida macroura*), Anna's hummingbird (*Calypte anna*), and ash-throated flycatcher (*Myiarchus cinerascens*). A wide variety of woodpecker species are primary-cavity nesters in oak trees, while house wren (*Troglodytes aedon*), western bluebird (*Sialia mexicana*), and American kestrel are secondary-cavity nesters (e.g., utilizing abandoned woodpecker cavities). Coastal oak woodland also is important to neotropical migrant songbirds (e.g., warblers, vireos, grosbeaks) providing feeding, resting, and nesting habitats. Raptors that nest and forage in the oak woodland habitat include great horned owl (*Bubo virginianus*), barn owl, western screech-owl (*Otus kennicotti*), red-tailed hawk, and red-shouldered hawk (*Buteo lineatus*). Cooper's hawk (*Accipiter cooperi*), white-tailed kite, and golden eagle (*Aquila chrysaetos*) are additional special-status bird species that have been recorded in woodlands and grasslands of the Stanford foothills.

More than 10 species of bats are common in the Stanford area, and individuals of some species roost in tree cavities. Townsend's big-eared bats (*Corynorhinus townsendii*) are occasionally recorded at Stanford and probably utilize local woodlands and riparian areas on a regular basis, at least for foraging.

Amphibian and reptile species that are found in the oak woodlands at Stanford include: California tiger salamander, western toad, Pacific treefrog, California slender salamander (*Batrachoseps attenuatus*), arboreal salamander (*Aneides lugubris*), sharp-tailed snake (*Contia tenuis*), ringneck snake (*Diadophis punctatus*), California kingsnake (*Lampropeltis getulus*), gopher snake, western terrestrial gartersnake (*Thamnophis elegans*), western skink (*Eumeces skiltonianus*), western fence lizard, southern alligator lizard (*Elgaria multicarinata*) and northern alligator lizard (*Elgaria coeruleus*). It is likely that California red-legged frogs (*Rana aurora draytonii*) regularly traverse many of the oak woodlands at Stanford.

2.3.3 Riparian Woodland and Creeks

Riparian woodland is well established along Matadero Creek and Deer Creek and along the creeks in the San Francisquito watershed. There also is a substantial riparian forest associated with the Searsville Reservoir. Vegetation along the creeks consists primarily of a moderately closed canopy of valley oak and coast live oak that ranges from approximately 20 to 40 feet in height. Associated species within this community include California buckeye, bay (*Umbellularia californica*), redwood (*Sequoia sempervirens*), willow (*Salix species*), and white alder (*Alnus rhombifolia*). An understory shrub layer occurs beneath much of the riparian canopy, particularly in areas where gaps in the overstory allow direct sunlight. Shrub species present include poison oak, California rose (*Rosa californica*), blackberry (*Rubus ursinus*), common snowberry, blue elderberry, bee plant, and coyote bush. The riparian forest associated with the Searsville Reservoir is dominated by willows, maples (*Acer species*), and dogwoods (*Cornus species*).

Small clumps of native and non-native grasses and forbs are present in the understory of the riparian woodland, including ripgut brome, wild oat, horehound (*Marrubium vulgare*), poison hemlock (*Conium maculatum*), wild radish (*Raphanus sativus*), field mustard (*Brassica rapa*), milk thistle, and California mugwort (*Artemesia douglasiana*). Aquatic vegetation found intermittently along the creek channels includes water cress (*Rorippa nasturtium-aquaticum*), iris-leaved juncus (*Juncus xiphioides*), broad-leaved cattail (*Typha latifolia*), and curly dock (*Rumex crispus*).

Riparian woodland provides abundant food, cover, and breeding habitat for wildlife. These factors and the structural diversity of riparian woodland are largely responsible for the high productivity of this habitat type. Bird species that are characteristic of this habitat at Stanford include California quail, mourning dove, orange-crowned warbler (*Vermivora celata*), Nuttall's woodpecker (*Picoides nuttallii*), black phoebe (*Sayornis nigricans*), black-crowned night heron (*Nycticorax nycticorax*), belted kingfisher (*Ceryle alcyon*), western wood-pewee (*Contopus sordidulus*), California towhee, and song sparrow (*Melospiza melodia*). Many of these species nest or roost in riparian woodlands and feed in adjacent habitat areas, such as annual grasslands. Stellar's jay (*Cyanocitta stelleri*) and western scrub jays are found in abundance in the riparian woodlands at Stanford, as are California thrasher, red-tailed hawk, Cooper's hawk, red-shouldered hawk, and sharp-shinned hawk (*Accipiter striatus*). Riparian woodlands also provide important feeding, resting, and nesting for neotropical songbirds such as warblers, vireos, grosbeaks, and flycatchers. Salt marsh common yellowthroat (*Geothlypis trichas sinuosa*) is relatively common at the margin of the riparian forest upstream of the Searsville Reservoir.

Common mammals found within this riparian woodland include: deer, opossum, raccoon, deer mice (including *Peromyscus* *truei* and *P. maniculatus*), Botta's pocket gopher, tree squirrels (*Scirus species*), San Francisco dusky-footed wood rat, California vole, coyote, gray fox, bobcat, striped skunk, and the non-native red fox (*Vulpes vulpes*). Merriam's chipmunk (*Eutamias merriami*) are also occasionally encountered in the riparian woodlands at Stanford, particularly in the large woodland track upstream from Searsville Reservoir. Recent work by a Stanford graduate student (Evelyn et al. 2004) indicates that the riparian areas at Stanford are used extensively by foraging bats. A number of bat species have been recorded including: Townsend's big-eared bat, red bat (*Lasiurus blossevillii*), hoary bat (*Lasiurus cinereus*), California myotis (*Myotis californicus*), Yuma myotis (*Myotis yumanensis*), long-ear myotis (*Myotis evotis*), fringed myotis (*Myotis thysanodes*), long-legged myotis (*Myotis volans*), big brown bat (*Eptesicus fuscus*), and western pipistrelle (*Pipistrellus hesperus*).

Amphibians and reptiles known to occur in this biotic community at Stanford include western toad, Pacific treefrog, California red-legged frog, arboreal salamander, black salamander (*Aneides flavipunctatus*), slender salamander, California newt (*Taricha torosa*), rough-skinned newt (*Taricha granulosa*), Santa Cruz ensatina (*Ensatina eschscholtzi*), California kingsnake, gopher snake, western night snake (*Hypsoglena torquata*), western fence lizard, southern alligator lizard, and western skink.

California tiger salamanders have not been recorded from Stanford's riparian zones. However, because of their ability to disperse from Lagunita, low numbers of salamanders could occur in riparian zones north of I-280.

Western pond turtles (*Clemmys marmorata*) are found scattered throughout San Francisquito Creek. They have been reported from Matadero Creek by local residents, but have not been observed during recent surveys. Newts (*T. torosa* and *T. granulosa*) are common in the San Francisquito system, but they have not been observed in Stanford's portion of the Matadero drainage during the recent surveys.

Native fish recorded from the Matadero and San Francisquito systems include three-spined stickleback (*Gasterosteus aculeatus*), roach (*Lavinia symmetricus*), Sacramento blackfish (*Orthodon microlepidotus*), Sacramento suckers (*Catostomus occidentalis*), and sculpin (*Cottus asper* and *C. gulosus*). Steelhead/rainbow trout (*Oncorhynchus mykiss*) are abundant in the San Francisquito system, but have not been recorded in the Matadero system in recent surveys conducted by Stanford (but have been reported as being historically present by numerous long-term local residents). Hitch (*Lavinia exilicauda*) are also present in the San Francisquito system.

San Francisquito Creek contains one of the few remaining steelhead runs in the San Francisco Bay drainage. Steelhead spawn throughout the San Francisquito Creek system, including those portions that flow through Stanford. Searsville Dam is a barrier to fish migration in the system, and isolates about 3 to 5 miles of suitable spawning habitat from migrating adults. Resident rainbow trout are present in the creeks above Searsville Dam (notably Corte Madera Creek and Sausal Creek), and are scattered throughout the system.

Native mussels (*Anodonta species*) are found scattered across the San Francisquito Creek system.

Non-native aquatic animals that have been recorded from the creeks at Stanford include bullfrog (*Rana catesbeiana*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), red-ear sunfish (*Lepomis microlophus*), mosquito fish (*Gambusia affinis*), largemouth bass (*Micropterus salmoides*), Louisiana red swamp crayfish (*Procambarus clarki*), and signal crayfish (*Pascifasticus leniusculus*). Bullfrogs are occasionally observed in the Stanford portions of Matadero Creek and Deer Creek; generally no more than three or four individuals are observed each year (and fewer than 10 bullfrog tadpoles have been encountered in Matadero and Deer creeks since the mid-1990s). Green sunfish are relatively common throughout the unincorporated Santa Clara County portion of Matadero Creek, but are limited in Deer Creek to reaches immediately upstream from its confluence with Matadero Creek (reaches that do not typically dry out). No young-of-the-year green sunfish have been observed in the Stanford portions of Matadero Creek and Deer Creek during annual surveys since 1997, suggesting that juvenile or adult sunfish may be dispersing into either downstream or upstream reaches. During recent annual surveys, only one largemouth bass was observed in the Stanford portion of the Matadero watershed and Louisiana red swamp crayfish are rarely encountered.

Mitten crabs (*Eriocheir sinensis*) have been observed in the San Francisquito system since at least 1996. The number of these invasive non-native crabs in the Stanford portions of the creeks varies each year. From 1996 to 1998, there were very few observations of crabs upstream of El Camino Real. In 1999 and 2000, hundreds of crabs were seen in San Francisquito Creek. Some individuals reach the confluence with Bear Creek. During 2001 through 2005, very few crabs were observed in the system. At the present time, the extent and impacts of this recent invasion are unclear.

In 2000, a mitten crab was observed in Matadero Creek, just downstream of the Foothill Expressway bridge (there were mid-1990s reports of mitten crabs at Matadero Creek's outflow into San Francisco Bay). Mitten crabs have not been observed in the areas of the creek that support red-legged frogs, but they could colonize the area in the future.

2.3.4 Serpentine Grasslands

There are two main areas of serpentine grassland at Stanford, both located in the Jasper Ridge Biological Preserve. These two areas are of limited extent, and the total acreage of serpentine grassland at Stanford is less than 25 acres. These grasslands have not been managed specifically to promote native biodiversity; a hands-off management policy has been in effect at the Preserve for more than 25 years. This policy was implemented in order to ensure that the inevitable vagaries of multi-year management activities did not unnecessarily affect the long-term research activities at the site. The grasslands do, however, still support an array of native plant and animal species, including California plantain (*Plantago erecta*), goldfields (*Lasthenia chrysostoma*), serpentine linanthus (*Linanthus ambiguus*), common linanthus (*Linanthus androsaceus*), red maids (*Calandrinia ciliata*), purple needlegrass, California man-root, California buttercup, poison oak, blue-eyed grass, terrestrial brodiaea, blue dicks, Ithuriel's spear, yarrow (*Achillia millifolium*), and common muilla (*Muilla maritima*).

Native insects are common in the serpentine grasslands at Stanford and the Lepidoptera in particular have been the focus of research efforts. The Bay checkerspot butterfly (*Euphydryas editha bayensis*) has been studied annually by Professor Paul Ehrlich's group at Stanford since 1960. This threatened butterfly subspecies formerly had two relatively robust populations at Stanford (a third population has been recorded in the literature [population "G"], but never supported butterflies for more than a few years). The Bay checkerspot butterfly has not been observed at Stanford since 1997 (despite hundreds of hours spent annually looking for them). Opler's longhorn moth (*Adela oplerella*) has not been recorded from Stanford, and is not expected since its obligatory host plant, California creamcups (*Platystemon californicus*), is rarely observed at Stanford. Several other species of Adela moths are common in the serpentine grasslands (*A. trigrapha* and *A. flammeusella*). Approximately 330 acres of grasslands at Stanford are designated as critical habitat for the Bay checkerspot butterfly.

A wide range of reptiles, mammals and birds can be found in the serpentine grasslands at Stanford. However, these are, by and large, the same species found in the annual grasslands and oak woodlands in the area. Botta's pocket gophers are typically found in very high densities in the serpentine grasslands at Stanford.

2.3.5 Chaparral and scrub

Chaparral and scrub are present at Stanford in several locations. There is a several-hundred-acre patch of chaparral located in the Jasper Ridge Biological Preserve. This chaparral includes dense stands of chamise (*Adenostoma fasciculatum*), buckbrush (*Ceanothus cuneatus*), yerba-santa (*Eriodictyon californicum*), toyon (*Heteromeles arbutifolia*), scrub oak (*Quercus berberidifolia*), poison oak, and black sage (*Salvia mellifera*). Scrub also is found on Coyote Hill and at Jasper Ridge. These areas are dominated by California sagebrush (*Artemisia californica*), coyotebrush, scrub oak, toyon, sticky monkeyflower, and California bee plant (*Scrophularia californica*).

Chaparral and scrub at Stanford provide habitat for a diversity of terrestrial wildlife. Amphibians include western toad and Pacific treefrog. Reptiles include western fence lizard, gopher snake, western racer, northern Pacific rattlesnake (*Crotalus viridus*), and western whiptails (*Cnemidophorus tigrus mundus*). Coast horned lizards (*Phrynosoma coronatum frontale*) have not been recorded at Stanford for several decades, but are present in chaparral located about 6 miles south of the University.

A wide range of mammals and birds can be found in the chaparral and scrub at Stanford. These are, however, primarily the same species found in the annual grasslands and oak woodlands in the area.

2.3.6 Seasonal Wetlands

The primary seasonal wetlands at Stanford are Lagunita and Skippers Pond. Both of these bodies of water support large numbers of aquatic invertebrates and vegetation. Pacific treefrogs are found in abundance in both bodies of water, and western toads frequently reproduce in large numbers in Lagunita. California newts do not typically use either of these waters. California tiger salamanders have been documented to reproduce in Lagunita since the early part of the 1900s. Bullfrogs are abundant in Skippers Pond in some years, and particularly when periods of above average rainfall allow the pond to retain water through the summer. A few bullfrogs are encountered in Lagunita every year, but no bullfrog tadpoles have been encountered there in at least 3 decades. Fish are generally not present in either Lagunita or Skippers Pond, but occasionally low densities of mosquito fish and goldfish are encountered. Crayfish also are found with some regularity in Lagunita. The timing of the crayfish's annual appearance always coincides with the annual crayfish cookout by one of the local dorms, so it has been assumed that the crayfish in Lagunita are the result of intentional releases. Pocket gophers are also abundant in the Lagunita area (so much so that the University Grounds Department must take active measures to control the numbers of gophers residing in the earthen dam that forms two-thirds of Lagunita's edge, as required by the California Division of Safety of Dams). Skunks and raccoons also are commonly encountered in the seasonal wetlands. Waterfowl are fairly abundant in Lagunita during the wet season. A number of reptile species occupy the Lagunita lakebed and surrounding grasslands, including western racer, kingsnake, gopher snake, and common garter snake (*Thamnophis sirtalis*).[2] Non-native red-eared slider turtles are also occasionally observed in the seasonal wetlands (presumably released into the sites by pet owners that do not understand the biological implications of releasing them).

2.3.7 Perennial Standing Water

Searsville Reservoir and Felt Reservoir support populations of fishes, most of which are non-native game species such as largemouth bass, black crappie, sunfish, and catfish. Neither Searsville Reservoir nor Felt Reservoir provide habitat for native aquatic species of conservation concern due to the presence of bullfrogs and abundance of non-native fishes. There are some roach, sculpin, hitch, and trout in the reservoirs, but the vast majority of fish in each are non-natives. However, prickly sculpins are common in Felt Reservoir, western toads reproduce well in Felt Reservoir, and both Searsville Reservoir and Felt Reservoir provide a habitat for water fowl and foraging areas for bats. Felt Reservoir and Searsville Reservoir are also used by both migratory and resident birds. Freshwater mussels (likely *Anodonta californiensis* and *A. oregonensis*) are present in Felt Reservoir. Non-native Chinese mystery snails (*Cipangopaludina chinensis*) and Lousiana red swamp crayfish are abundant in Felt Reservoir. Western pond turtles and non-native turtles (red-eared sliders) are also sporadically present in Felt Reservoir.

2.3.8 Urban/Suburban

Urban landscape includes both native and non-native vegetation growing within the main campus and around residential areas of Stanford lands. Vegetation consists of remnant native species, such as oaks, as well as non-native trees (primarily Eucalyptus), ruderal annual grasslands, and ornamental landscape plants.

In rare instances the urban/suburban areas can provide habitat elements for wildlife, including cover for nesting and roosting, and foraging sites. Except for the occasional tiger salamander that wanders into the main campus from Lagunita, the central campus and other developed areas do not support individuals of the Covered Species. It should be noted that the tiger salamanders which do find themselves in the main campus have an exceedingly low chance of getting back to either Lagunita or the ponds in the foothills; in addition to the large numbers of buildings, roads, drains, and simple curbs on the main campus, there many retaining walls and stairs located in the main campus. Since Lagunita is uphill from most of the main campus, these retaining walls and stairs form a unidirectional barrier to California tiger salamander dispersal; individuals dispersing from Lagunita can essentially fall down steps or over a retaining wall and reach the main campus, but the reverse trip is virtually impossible because the tiger salamanders have limited climbing abilities.

Native and introduced animals that are tolerant of human activities can thrive in urban landscapes. These species include: western fence lizard, southern alligator lizard, northern mockingbird, barn swallow, raccoon, striped skunk, European starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), house finch (*Carpodacus mexicanus*), eastern grey squirrel (*Sciurus caralinensis*), fox squirrel (*Sciurus niger*), house mouse (*Mus musculus*), Norway rat (*Rattus norvegicus*), black rat (*Rahus rattus*), and opossum. Highly urbanized areas such as the Stanford Shopping Center, Stanford University Medical Center, and the Stanford Research Park consist of very intensely developed landscapes that have little value to native wildlife (Blair 1996, Blair and Launer 1997).

2.3.9 Plant Species

More than 650 species of native vascular plants have been recorded from Stanford and vicinity. There are a number of these plant species that are considered by the California Native Plant Society as being of conservation concern. These include: Franciscan onion (*Allium peninsulare franciscanum*, CNPS 1b), western leatherwood (*Dirca occidentalis*, CNPS 1b), woolly-headed lessingia (*Lessingia hololeuca*, CNPS 3), serpentine linanthus (*Linanthus ambiguous*, CNPS 4), chaparral bush mallow (*Malocothamnus fasciculatus*, CNPS 1b [as *M. arcuatus*), Gairdner's yampah (*Perideridia gairdneri gairdneri*, CNPS 4), Michael's piperia (*Piperia michaelii*, CNPS 4), Mt. Diablo cottonseed (*Stylocline amphibola*, CNPS 3), Hickman's popcornflower (*Plagiobothrys chorisianus var. hickmanii*, CNPS 4), coast rock cress (*Arabis blepharophylla*, CNPS 4), fragrant fritillary (*Fritillaria liliacea*, CNPS 1b), mountain lady's slipper (*Cypripedium montanum*, CNPS 4), spring lessingia (*Lessingia tenuis*, CNPS 4), bristly linanthus (*Linanthus acicularis*, CNPS 4), California rockjasmine (*Androsace elongate acuta*, CNPS 4), showy Indian clover (*Trifolium amoenum*, CNPS 1b), and San Francisco blue-eyed marry (*Collinsia multicolor*, CNPS 1b). Most of the species have not been recorded at Stanford for many decades. If present, these species are found predominately on Jasper Ridge, although the western leatherwood is also found scattered through the oak and riparian woodlands of campus. While conservation measures enacted by Stanford during the course of this HCP will undoubtedly benefit several of these species, no plant species are explicitly covered by this HCP.

In addition to the native species of plants, more than 325 species of non-native plants have been found growing outside of landscaped areas at and near Stanford, and new species of non-native plants invade the area on a regular basis. Many of these exotic species are highly invasive and destructive weeds. Control of these species is often extremely difficult, and man-

[2] Studies have shown that the common garter snake found at Stanford appears to be an intergrade form between the San Francisco garter snake (*T. s. tetrataenia*) found to the north and west, and the red-sided garter snake (*T. s. infernalis*) found to the south and east (Barry 1994).

agement efforts are ongoing. Some of the more problematic exotic plant species at Stanford are mustard (*Brassica species*), ripgut brome, stinkwort (*Dittrichia graveolens*), Italian thistle, yellow star-thistle, purple star-thistle, pampas grass (*Cortaderia selloana*), storkbill (*Erodium species*), fennel (*Foeniculum vulgare*), broom (*Genista maderensis* and G. *monspessulana*), Italian ryegrass, Harding and canary grass (*Phalaris species*), wild radish, and medusa-head (*Taeniatherum caput-medusae*). Ivy (*Hedera helix*) and greater periwinkle (*Vinca major*) are found in high densities in a number of locations scattered along the creeks and in moist forested areas. Giant reed (*Arundo donax*) is present in a few locations at Stanford and has been the target of focused eradication efforts. Parrot's feather (*Myriophyllum aquaticum*) occasionally reaches potentially problematic densities at Searsville Reservoir.

2.3.10 Animal Species

Nearly 240 species of vertebrates, including 150 species of native birds, are found at and near Stanford. In addition to the native bird species, more than 45 species of mammals, 19 species of reptiles, 11 species of amphibians, and 8 species of fishes native to the area have been recorded. In addition, subfossil remains of a host of other vertebrate species have been found at Stanford. Grizzly bear (*Ursus arctos*), pronghorn (*Antilocapra americana*), tule elk (*Cervus elaphus*), and roadrunner (*Geococcyx californianus*) are among the species recently extirpated from the area.

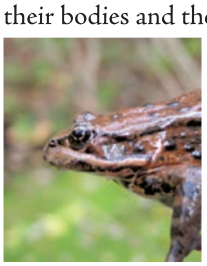
Approximately 30 non-native vertebrate species are present in the area and some pose problems for conservation efforts. The non-native centrarchids (sunfish and largemouth bass), bullfrog, starling, and red fox potentially cause the most difficulties for native wildlife.

In addition to the vertebrate species, a large number of species of invertebrates are found at Stanford, including more than 30 species of butterflies and skippers, and 55 species of odonates.

2.4 COVERED SPECIES

2.4.1 California red-legged frog

Description. California red-legged frogs are the largest frogs native to California, reaching sizes upwards of 4.5 inches in body length. Adult frogs are variable in color but are often characterized by the rich red coloration of the lower sides of their bodies and the under-surfaces of their hind limbs. Upper portions of red-legged frogs are red-pink to green-brown, with irregular black mottling on dorsal surfaces of the back and thighs. There are dorsolateral folds extending from the hips to eyes on both sides of the body.



Red-legged frog tadpoles are brown, often with a pinkish sheen on their undersides, and commonly reach 3 inches in total length. Tadpoles may be mottled with irregular dark spots, but they do not have the pencil-point black dots typical of bullfrog tadpoles. Juveniles are generally less than an inch in body length at metamorphosis, and more brown-green than red.

Eggs are laid in loose clusters, generally in shallow water. These rough egg masses are clear to yellow brown or grey in color, with a dark developing embryo in each individual egg.

Natural History. Red-legged frogs typically live in still freshwater such as ponds, lakes, and marshes, or in slow flowing sections of creeks and streams. Local reproduction generally begins in late January and lasts through March. Minimum breeding age appears to be 2 years in males and 3 years in females (Jennings and Hayes 1985). Females lay 750-4,000 eggs in clusters attached to aquatic vegetation, 2 to 6 inches below the water surface. Eggs hatch in 2 to 3 weeks. Once hatched, the tadpoles generally take between 11-20 weeks to metamorphose, doing so between May and August. Tadpoles can reach 3 inches total length just prior to metamorphosis. Individual frogs average 1 ¼ inches in snout-vent length at metamorphosis.

Adults feed on a wide range of invertebrates and small vertebrates including aquatic and terrestrial insects, snails, crustaceans, fish, worms, tadpoles, small mammals, and smaller frogs (including members of their own species). The aquatic larvae (tadpoles) are primarily herbivorous. When threatened, adult and juvenile California red-legged frogs generally seek refuge in water; they will dive rapidly to the bottom of deeper pools and seek refuge under cover. R. a. draytonii is prey for a number of species, including bullfrogs, largemouth bass, snakes, raccoons, dogs, foxes, coyotes, cats, herons, and egrets. Crayfish are also thought to prey upon red-legged frog eggs and tadpoles. Newts may eat red-legged frog eggs. Late season heavy rains also wash away egg masses and young tadpoles.

The maximum longevity of red-legged frogs is not known, but an individual of a closely related subspecies (*Rana aurora aurora*) was known to live in captivity for 13-15 years (Cowan 1941).

Some scientists believe that California red-legged frogs are relatively inactive during dry periods of the year or during droughts. California red-legged frogs are known to occasionally disperse widely during autumn, winter, and spring rains. Juveniles use the wet periods to disperse outward from their pond or stream of origin, and some adults have been found to move considerable distances, often well away from aquatic resources. Frogs disperse through many types of upland vegetation and use a broader range of habitats outside of breeding season.

Habitat and Range. Populations of California red-legged frogs are thought to require permanent or nearly permanent bodies of water for persistence. Red-legged frogs are known to occur,

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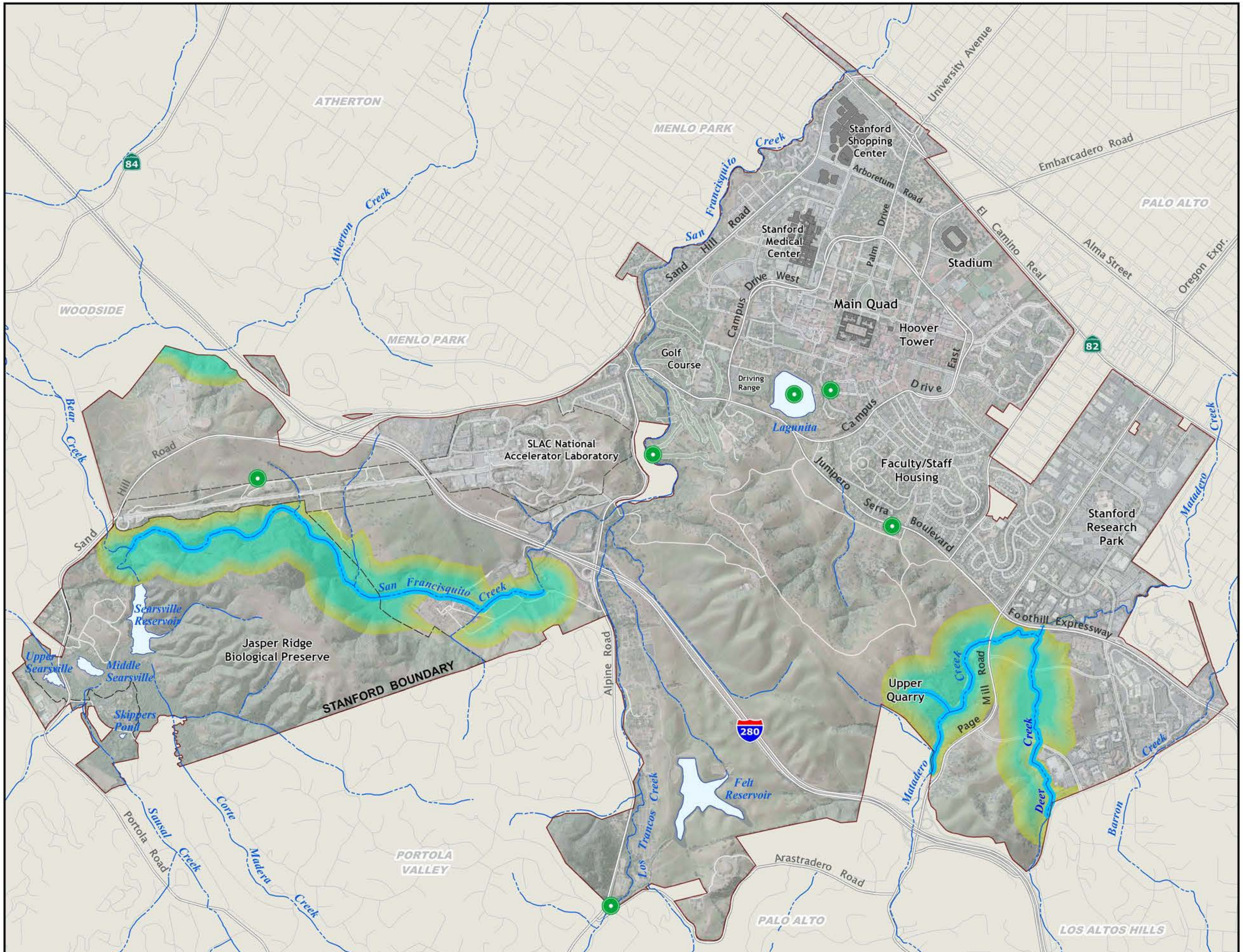

California Red-Legged Frog at Stanford

Occupied Creek
(Creek widths exaggerated)

Associated Uplands

Outliers / Historical Records

hectare

100

25

4

acres

Sources:
CRLF habitat: Stanford Unv. Campus Biologist, 2006
Aerial photos: Aerotopia, 1999
Creeks: US Geological Survey, 1991

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This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

N

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Figure 2-2

at least temporarily, in grassland, riparian woodland, oak woodland, and coniferous forest, but prefer quiet pools, slow-flowing streams, and marshes with heavily vegetated shores for reproduction. California red-legged frogs are frequently encountered in areas of relatively unfiltered sunlight. Seasonal bodies of water are frequently occupied by red-legged frogs, and in some areas these water bodies may be critical for persistence.

While typically associated with bodies of water, individual California red-legged frogs occasionally traverse many miles of non-wetlands during rainy periods. It is also thought that members of some California red-legged frog populations spend most of their lives well away from the wetlands where they reproduce, either in other wetlands or simply in moist, vegetation-covered areas. Historically, California red-legged frogs were found throughout California from Mendocino County in the north to Baja California in the south. The range is considerably reduced, particularly in southern and eastern areas of California, where the California red-legged frog has all but disappeared. A related subspecies (*Rana aurora aurora*) persists in northern California, and ranges north into British Columbia.

Threats. Natural threats to the California red-legged frog include predation by fishes, snakes, birds, mammals, and other frogs. However, loss of habitat and the introduction of non-native species that compete with or prey upon both adult and larval red-legged frogs are much more significant to the fate of the red-legged frog. Disruption or destruction of suitable habitat has been a major cause of the decline in California red-legged frogs over much of their former range (Davidson et al. 2001). Development of land for agricultural or urban uses has significantly reduced frog populations. Introduced species, such as bullfrogs, crayfish, sunfishes (*Lepomis* species), and largemouth bass, also pose challenges to red-legged frogs, competing for resources and often preying directly upon larval and adult frogs (Alvarez et al. 2003, Doubledee et al. 2003). The introduction of non-native species is also thought to play a role in the spread of disease, particularly chytridiomycosis. A chytrid fungus, very likely *Batrachochytrium dendrobatidis*, is the cause of chytridiomycosis and has been linked to numerous amphibian declines across the world. Given the vulnerability of the remaining populations of California red-legged frogs, this pathogen is considered a major threat.

California red-legged frogs at Stanford. California red-legged frogs have been monitored annually on Stanford lands since 1997. These surveys have documented two distinct frog populations, one along Matadero and Deer creeks, and one along San Francisquito Creek (Figure 2-2). Prior to the construction of Highway 280 and the general suburban buildup of the area, it is likely that these two populations were part of a single, more widespread population.

Annual surveys conducted since 1997 have documented red-legged frog reproduction in Deer Creek and Matadero Creek and in a pool associated with the "Upper Quarry." California red-legged frog reproduction in Matadero Creek appears to be very limited, with only a few tadpoles surviving to metamorphosis each year. In some years, Deer Creek is more productive, with large numbers of mature tadpoles (hundreds) and metamorphs (tens) observed in comparatively wet years. However, it appears that no successful red-legged frog reproduction occurs in Deer Creek during conditions of moderate to severe drought. Reproduction in the quarry pool is fairly consistent, but the pool is somewhat unusual because California red-legged frog tadpoles are present in the pool year-round. (Fellers et al. 2001).

California red-legged frogs also are found along the Stanford portions of San Francisquito Creek. Recent observation of red-legged frogs in San Francisquito Creek have been limited to the reaches located downstream from the confluence with Bear Creek (in the Jasper Ridge Biological Preserve) to within 2 miles (along the creek) upstream from the Interstate 280 bridge. Red-legged frog reproduction in this area has been variable, with few tadpoles (~20) seen most years since 1997, but with 50+ seen in some years (particularly when weather conditions have caused side-pools to form).

California red-legged frogs have been found in Los Trancos Creek upstream of Stanford, but only one red-legged frog has been found along Stanford's portion of the creek since the early-1990s. Los Trancos Creek provides cool, clear water that is not typically red-legged frog habitat. However, the creek corridor may serve as a dispersal corridor. Most of the recently observed frogs were found well upstream of Stanford, and there is only a single recent record of a California red-legged frog from Stanford's portion of Los Trancos Creek. In 1995, a single frog was repeatedly observed in the roots of a large bay tree located just downstream of the Los Trancos Diversion facility.

There have been other sporadic records of California red-legged frogs in the San Francisquito watershed. There are unsubstantiated records from the 1970s of red-legged frogs in San Francisquito Creek immediately south of the golf course, near the non-Stanford residences along Bishop Lane (a reach some 1.5 to 3 miles downstream from the frog's current distribution). Recent verified observations have been lacking.

While recent observations of red-legged frogs away from the creeks have been few, it is apparent that some individuals disperse far from the riparian zone. A large red-legged frog was found in January 2000 as a road-kill along Junipero Serra Boulevard, opposite Frenchman's Road (approximately 1 mile from the nearest creek site known to support frogs). In 2006, two red-legged frogs were reported from an area between SLAC and Sand Hill Road. Multiple subsequent surveys at the site failed to observe any California red-legged frogs, but, given the location, transient individuals are not unexpected. Other historic records of California red-legged frogs at Stanford indicate that in the early- and mid-part of the last century, they were occasionally found in Lagunita and in the goldfish pond of the Kingscote apartment building on campus. No California red-legged frogs have been observed at these central campus locations for many decades.

At Stanford, several factors threaten California red-legged frogs, including loss of habitat, predation and competition by non-native species, disruption of dispersal routes, and direct interaction with people and domestic animals. Historic reductions of riparian forests, loss of side pools, and degradation of seasonal tributaries have undoubtedly also impacted local frog populations.

The local populations of red-legged frogs have probably declined considerably during the last 50 years. Anecdotal accounts and specimen locations indicate that red-legged frogs were more widespread and probably abundant in many locations where the frog is now absent. Most likely, no single major reason for this decline exists, but rather the decline is the result of long-term changes to the area that have occurred with increased urbanization.

Notes. There is a sizable concentration of red-legged frogs located on the Lawler Ranch, which is adjacent to Stanford, west of Sand Hill Road. It is presumed that frogs reproducing in the ponds and creeks present in the Lawler Ranch occasionally occupy adjacent upland areas owned by Stanford. The Lawler Ranch population is separated from the red-legged frogs present in San Francisquito Creek by Sand Hill Road and the SLAC National Accelerator Laboratory (SLAC).

Rana aurora draytonii was first listed as a threatened species by the Service in 1996.

The California red-legged frog, *R. a. draytonii*, is different from the northern red-legged frog, *R. a. aurora*, having larger size, rugose skin, distinct spots with light centers along its dorsal line, and prominent dorsolateral folds. Behavioral and genetic differences are discussed by Hayes and Miyamoto (1984). Recent genetic analyses (Shaffer et al. 2004a) have further documented these differences, and many consider the California red-legged frog and the northern red-legged frog to be two distinct species (*Rana draytonii* and *Rana aurora* respectively)

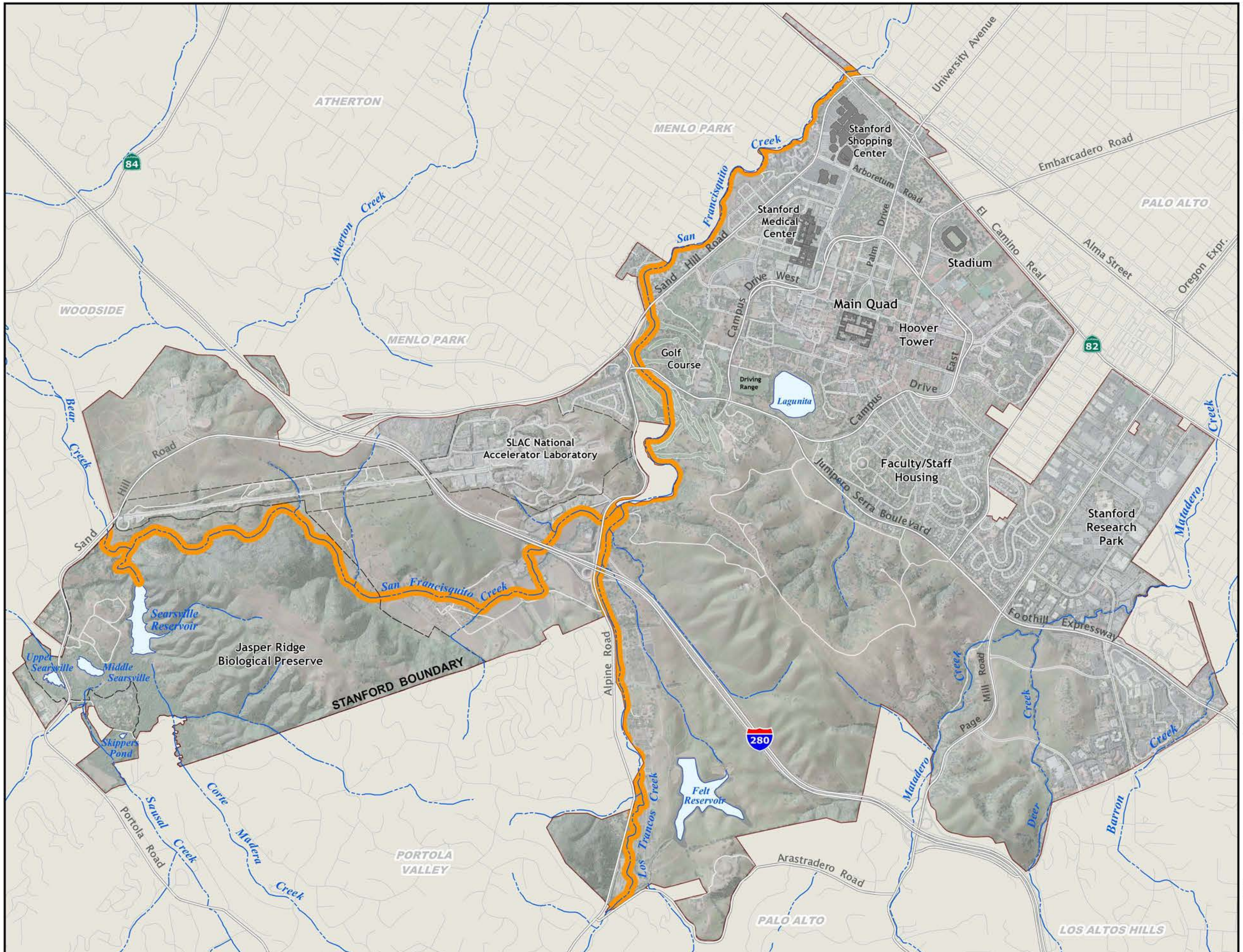
2.4.2 Steelhead

Description. Steelhead are the anadromous form of Oncorhynchus mykiss; non-anadromous forms are referred to as rainbow trout. The coloration of adults is highly variable and may range from silvery with faint dark spotting to dark dorsal coloration with a faded lateral red band and heavy spotting; individuals that are in marine environments or have recently returned to freshwater from marine environments are usually quite silvery white-blue in color, with some dorsal spotting. Young steelhead, or parr, are similarly colored with the exception that they have between 8 and 13 widely spaced marks (parr marks) along the lateral line. During smoltification, the dark parr marks will usually fade, and the smolts become lighter and more silvery as they descend the streams and enter salt water. During the time that they are in freshwater, parr and smolt are generally less than 10 inches in total length; returning adults can be 15 to 25 inches in total length.

Natural History. Steelhead spawn in fresh water streams and rivers, and typically spend the first to second years of their lives as residents of their natal stream. After obtaining sufficient size, parr begin a transformation called smoltification, a physical and behavioral transition from freshwater form to a form that is able to survive in marine environments. In freshwater, steelhead feed on drift organisms, benthic invertebrates, and small fish. As with other salmon of the Pacific Basin (all members of the genus Oncorhynchus), steelhead return to the same stream in which they were hatched. Steelhead generally spend several years living in coastal marine environments prior to initial spawning or between repeated spawning events. Unlike other Pacific Basin salmon, not all steelhead die after spawning, and many individuals are able to complete the migration cycle multiple times in their lives (but only once per year). Spawning and the migration it requires are, however, quite difficult, and most individuals are unable to survive multiple spawning migrations. In most southern watersheds, including those on the Stanford campus, steelhead are late winter/early spring spawners, but in some systems there are fall or summer runs (Fukushima and Lesh 1998, McGinnis 1984, Shapovalov and Taft 1954). Maximum fish age is usually 7 or 8 years.

Habitat and Range. Steelhead are native to coastal streams from Baja California to Alaska (and parts of Asia). During their time as stream residents, steelhead require water that is generally cool, 10-21° C, and saturated with oxygen (Moyle 1976). These requirements are best satisfied in sections of stream that have cool and clear water input, and are relatively fast-moving. Breeding steelhead have similar temperature and oxygen requirements for creating their nests (redds), and typically spawn in shallow-water gravel beds with rapid flow. Water flow within the gravel beds promotes egg and alevin survival. Adult steelhead that are waiting to spawn also are restricted to relatively cool water and tend to hold in deep pools. Reaches of stream used for rearing by fry and parr benefit from cover, in the form of woody debris, large boulders, and undercut banks. Shade-providing riparian vegetation is often very beneficial for steelhead because it keeps water temperatures low supports insects which are a source of food. Surface turbulence, areas of white water, also provides cover for steelhead and saturates the water with oxygen.

Threats. There has been a long-term decline of steelhead populations in the last century leading to the listing of Central California Coast (CCC) steelhead as threatened under the ESA in 1997. Degradation of spawning streams has been cited as a main factor in their decline (Moyle 1976). Dams and



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Steelhead at Stanford

Occupied Creek
(Creek width exaggerated)

hectare
100
25
4
acres

Sources:
SH habitat: Stanford Unv. Campus Biologist, 2006
Aerial photos: Aerotopia, 1999
Creeks: US Geological Survey, 1991

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Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

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Figure 2-3

other water migration barriers, water diversions, removal of riparian vegetation, decreased water quantity and quality, and the presence of non-native fish all affect the quality of habitat in steelhead spawning streams. Pollution is also a threat to salmonids, including steelhead. The presence of non-native species, including non-local forms of rainbow trout, can also threaten steelhead populations.

Steelhead at Stanford. Steelhead have long been documented to be present in the San Francisquito watershed (Figure 2-3), but, as with the vast majority of salmonid runs, few specifics are known about the mean number of individuals annually spawning in the system. Estimates range from zero in drought years to several hundred adult fish during wet years. At Stanford, relatively large numbers of parr are typically found in Los Trancos Creek and in a few portions of San Francisquito Creek and Bear Creek. Given the flashy nature of the system and physical limitations of the creek beds, redd surveys have not yielded results that are quantitatively valid. Following a working definition from NOAA Fisheries, all *O. mykiss* from within a zone of anadromy, an area where at least some of the individuals are migratory, are considered steelhead. At Stanford, all *O. mykiss* downstream of Searsville Dam, including Los Trancos and Bear creeks, are classified as steelhead. All *O. mykiss* upstream of Searsville Dam are considered rainbow trout, because they never migrate to marine environments.

There are non-migratory adults in the downstream reaches of San Francisquito, Los Trancos, and Bear creeks and would be called rainbow trout if they were not found in the zone of anadromy. These individuals exhibit color patterns typical of rainbow trout: silvery green-white base color with many spots, a wide pinkish band along the lateral line, and generally a pinkish red gill cover.

At Stanford, spawning typically occurs from February to April. Parr generally rear in the creeks for one to two summers, but are commonly land-locked for additional years if drought conditions are present. Searsville Dam is a barrier to fish migration on Stanford lands. Resident rainbow trout also are found in the San Francisquito Creek watershed.

Pollutants, including those that originate upstream, can negatively affect steelhead at Stanford. Throughout the system, eutrophic runs and pools are not uncommon by the end of summer. In portions of the creek immediately downstream from Searsville Dam, the water becomes tainted with a naturally occurring heavy load of decaying plant material, resulting in coffee-colored water by the end of summer. Non-native fishes and invertebrates also present a threat to steelhead in the San Francisquito watershed. However, most of the non-native fishes are concentrated in the portion of the system immediately downstream from the Searsville Dam, and very few non-native fishes are encountered farther than 0.5 miles downriver from the dam. Since the mid-1990s, non-native fishes have only spawned downstream of the reservoir on a few occasions, and it is therefore assumed that Searsville Reservoir is the primary source of non-native fishes in the system. The live bearing non-native mosquito fish, *Gambusia affinis*, is an exception and is found in low abundance throughout the system. Stanford annually performs efforts to monitor and control infestations of non-native fishes. These efforts were initiated in 1997 and appear to have been successful at reducing the presence of non-native fishes in areas immediately downstream from Searsville Dam.

Perhaps the primary limiting factor for steelhead in this portion of their range is the low amount of water present in the system during the annual dry season and during periods of drought. San Francisquito Creek frequently experiences drought and low water conditions. During most years, fairly extensive portions of the system dry out. During drought years, particularly during the summer months, creek drying is much more extensive and portions of the creek become dry as early as late April. The impacts of creek drying on steelhead are manifold: even short-distance dispersal through the natural channels is prevented, water quality can be rendered unsuitable, and steelhead become overly concentrated in small areas. Concentrating individuals in areas of declining water quality can increase mortality due to physiological stress and increased predation. Other potentially limiting factors include relatively low channel/stream complexity (e.g., low levels of large woody debris and other structure-providing features), the general paucity of suitable spawning sites, and the variable quantities of prey.

Non-native crayfish are widespread in the system, but are uncommon in Los Trancos Creek. Mitten crabs have recently been observed in the San Francisquito watershed, but their numbers present at Stanford vary considerably from year to year. There is no direct evidence that the steelhead population reproducing in the San Francisquito watershed has declined in the last 100 years or is declining at the present time.

2.4.3 California tiger salamander

Description. California tiger salamanders are large salamanders, with adults frequently reaching 7.5 inches or more in total length. These are thick-bodied salamanders with broad heads and blunt snouts. Adults are black or dark grey, with oval to bar-shaped spots ranging in color from white to yellow. Juveniles are dark olive green in color and do not generally have any lighter markings.

Larval tiger salamanders have external gills and are olive green in color, generally with very fine dark markings (stippling).

Eggs are laid underwater singularly or in small groups, on subsurface portions of emergent vegetation or other debris. Each egg is approximately 0.25 to 0.5 inches in diameter, including a thick gelatinous layer.

Natural History. Adult tiger salamanders are rarely seen, even during the breeding season when they are most active above ground. For most of the year, they live in the burrows of ground squirrels, gophers, and other rodents in open wooded or grassy areas. Occasionally, tiger salamanders are found in various man-made structures including buildings and drainage pipes. They are found on the surface during periods of damp weather, almost exclusively at night.

Breeding occurs during the winter rainy season. The breeding season begins with a migration of adults to the seasonal wetlands where breeding occurs. This migration typically begins with the second or third heavy rain of the season, and may consist of moves in excess of 0.5 miles, though most movements are less than 500 yards (Loredo et al. 1996, Trenham et al. 2001, Trenham et al. 2000). Movement occurs on the surface, and possibly underground through rodent burrows as well. Most male tiger salamanders at Stanford are ready to start breeding when they are 3 years old; most females require an additional year to reach sexual maturity.

Eggs are laid underwater singularly or in small groups, on subsurface portions of emergent vegetation or other debris. Young are aquatic and prefer the cover of vegetation to open water. Larvae feed on anuran tadpoles and various aquatic invertebrates such as crustaceans, zooplankton, snails, and insect larvae. These salamanders metamorphose into land-dwelling juveniles by May or June. After metamorphosis, the juvenile salamanders eat a wide variety of insects and other invertebrates. Juveniles generally remain near the breeding site until autumn rains, at which time they disperse to upland areas.

Habitat and Range. California tiger salamanders require a complex mixture of habitats, consisting of seasonally filled pools located in or near grasslands or oak woodlands (Trenham 2001, Trenham and Shaffer 2005). Semi-permanent ponds and reservoirs, and portions of slow-moving, seasonal creeks, also may be used. Safe and easy access between these habitats is vital, as migration between them is a vulnerable part of the salamanders' life cycle. Seasonal water is important because it usually has fewer predators than permanent bodies of water. Fish in particular are known to have a "significant negative impact on the survival of [salamander] eggs and larvae" (Shaffer et al. 2004b).

The California tiger salamander ranges from west of the Sierra Nevada crest, from Sonoma and Yolo Counties in the north to Santa Barbara County in the south, and west to the outer coast range. It is believed that the salamander population on the Stanford University campus represents the only population remaining on the San Francisco Peninsula. These salamanders apparently live in the grassland and foothills surrounding Lagunita and migrate to Lagunita to breed.

Threats. California tiger salamander populations have declined significantly in California. The main cause is fragmentation and destruction of habitat by agricultural and urban development. Introduced species, such as other species of salamanders that hybridize with native tiger salamanders, may be a problem in some locations (Fitzpatrick and Shaffer 2004, Riley et al. 2003). Natural predators of tiger salamanders include herons, waterfowl, raccoons, snakes, and small mammals such as skunks. Weather is a very important determinant of salamander reproductive success. In seasons with heavy early rain, which will trigger migration and reproduction, but little or no mid- to late-season rain, many salamander larvae will not grow enough for successful metamorphosis and survival. Likewise, un-seasonally heavy rains can trigger salamander migrations that result in high levels of mortality (Holland et al. 1990).

California tiger salamanders at Stanford. At the present time, California tiger salamanders are concentrated around Lagunita, with the density of salamanders decreasing significantly as the distance from Lagunita exceeds 0.75 miles (Figure 2-4). The distribution of salamanders is not random, and in the heavily developed area of campus very close to Lagunita, few, if any salamanders are present. Much of the main campus is a population sink for salamanders, which means that any individual unlucky enough to get into the main campus will find it virtually impossible to migrate back to Lagunita. Most of the main campus is downhill from Lagunita, and a myriad of curbs, steps, buildings, drains, and retaining walls block migrating salamanders from reaching Lagunita. Therefore, salamanders found in the main campus are essentially lost from the breeding population, because they have virtually no chance of reproducing successfully.

Scientists have studied the California tiger salamander at Stanford and vicinity for more than 70 years (Twitty 1941). Early work focused on local distribution and factors associated with migrations. Recent work has been centered on conservation planning for the salamanders. This work, which started in the early 1990s, has involved many Stanford-affiliated workers and researchers, including undergraduates (two of whom conducted honors work on the local salamanders), graduate students, post-doctoral fellows, research associates, and hired consultants and other experts. Work by non-Stanford scientists on the Lagunita population has also been conducted on a sporadic basis (Barry and Shaffer 1994).

Much of the recent work was conducted to implement the California Tiger Salamander Management Agreement. This agreement is between Stanford, Santa Clara County, California Department of Fish and Game (CDFG), and the Service and was signed in June 1998. One of its key elements was the designation of a California Tiger Salamander Management Zone. Another important element of the California Tiger Salamander Management Agreement was the construction in the late 1990s of five small seasonal wetlands (ponds) south of Junipero Serra Boulevard. These ponds were classified as experimental and

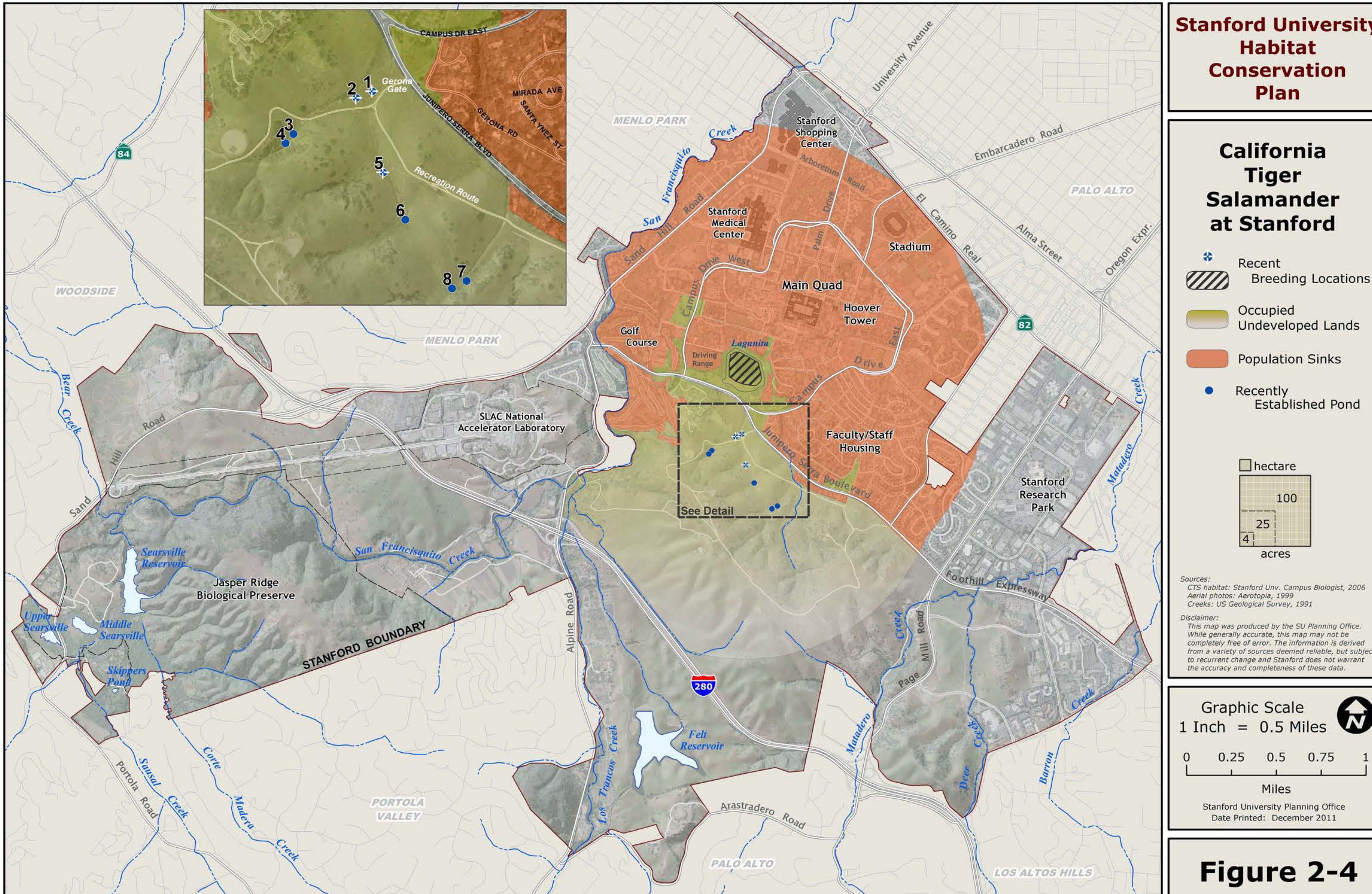
Stanford University Habitat Conservation Plan
California Tiger Salamander at Stanford
Recent Breeding Locations
Occupied Undeveloped Lands
Population Sinks
Recently Established Pond
hectare
100
25
4
acres
Sources:
CTS habitat: Stanford Unv. Campus Biologist, 2006
Aerial photos: Aerotopia, 1999
Creeks: US Geological Survey, 1991
Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.
Graphic Scale
1 Inch = 0.5 Miles
0 0.25 0.5 0.75 1
Miles
Stanford University Planning Office
Date Printed: December 2011
CAMPUS DR EAST
Gerona Gate
MIRADA AVE
SANTA YNEZ ST
GERONA RD
JUNIPERO SERRA BLVD
Recreation Route
1
2
3
4
5
6
7
8
MENLO PARK
WOODSIDE
PALO ALTO
PORTOLA VALLEY
LOS ALTOS HILLS
84
82
280
University Avenue
Embarcadero Road
El Camino Real
Alma Street
Oregon Expr.
Stanford Shopping Center
Arboretum Road
Palm Drive
San Francisquito Creek
Sand Hill Road
Stanford Medical Center
Stadium
Campus Drive West
Campus Drive East
Main Quad
Hoover Tower
Golf Course
Driving Range
Lagunita
Faculty/Staff Housing
Junipero Serra Boulevard
See Detail
SLAC National Accelerator Laboratory
Stanford Research Park
Matadero Creek
Foothill Expressway
Bear Creek
Searsville Reservoir
Jasper Ridge Biological Preserve
Upper Searsville
Middle Searsville
Skippers Pond
STANFORD BOUNDARY
Alpine Road
Los Trancos Creek
Felt Reservoir
Arastradero Road
Page Mill Road
Deer Creek
Barron Creek
Sausal Creek
Corte Madera Creek
Portola Road

Figure 2-4

were expected to be modified as their performance was evaluated. The goal of these wetlands is to provide supplemental breeding locations for California tiger salamanders, reduce the reliance of the local population on Lagunita, and extend their effective range farther into the foothills. By 2001, Stanford determined that two of the ponds were essentially non-functional and a third lost capacity during the floods of 1998. The two remaining ponds worked as designed, but were considered too small to contribute significantly to the persistence of the local California tiger salamander population. The constructed wetlands, however, supported large numbers of Pacific treefrogs and western toads, an array of invertebrates, and were used by a wide variety of mammal and bird species. In Fall 2003, following 2 years of consultation and permitting by the Service, CDFG, California Regional Water Quality Control Board, U.S. Army Corps of Engineers, and Santa Clara County, the two remaining ponds were reconstructed and enlarged, and six additional ponds were built. By 2010, California tiger salamanders had reproduced in three of the ponds (Launer 2010). Two of the ponds have successfully supported California tiger salamander reproduction during multiple years (California tiger salamanders have reproduced in Pond #1 during four seasons and have reproduced in Pond #5 in two seasons). California tiger salamanders have reproduced in Pond #2 during one season. Four additional ponds have held water long enough to support California tiger salamander larval development during multiple years, but were not utilized by California tiger salamanders.

In addition, Stanford installed three amphibian tunnels under Junipero Serra Boulevard to help reduce traffic-caused mortality of salamanders during their migration between Lagunita and the lower foothills.

Non-native tiger salamanders are occasionally found at Stanford. During the last decade, intensive annual fieldwork has turned up three individuals that were clearly not California tiger salamanders (out of more than 1,000 observations of adult and juvenile tiger salamanders). Researchers at UC Davis found that the tiger salamanders at Stanford are native salamanders, of distinct genetic stock, and have not been compromised by introgression with non-native species (Shaffer et al. 2004b). At the present time, non-native tiger salamanders are not considered a huge threat to the local salamander population. But, the threat from non-native salamanders remains a concern because virtually every pet store in the vicinity regularly sells a number of non-native tiger salamander species, and hybridization is a big problem elsewhere in the state.

Mortality due to traffic is quite high, a finding first noted by Victor Twitty at Stanford more than 50 years ago (Twitty 1941). This finding has been confirmed by more recent data from ongoing work by Stanford and by a study by the Coyote Creek Riparian Station (Rigney et al. 1993).

Old records indicate that California tiger salamanders were more widespread in northern Santa Clara and southern San Mateo counties. At Stanford, it is unclear whether the population is declining or remaining steady. It is quite possible, however, that the local California tiger salamander population increased dramatically 100 years ago with the construction of Lagunita.

The Service listed the California tiger salamander as threatened in 2004. The California tiger salamander was listed as threatened in 2010 under the California Endangered Species Act (CESA).

Notes. For a period during the late 1970s and 1980s, the population of tiger salamanders at Stanford was believed by some to be extinct. This was apparently due to a conspicuous lack of suitable observers. The salamanders "publicly" appeared during the winter of 1991-1992 and have been monitored annually since their reappearance.

At least two other "populations" of tiger salamanders once existed in the Stanford area, and there were reports of California tiger salamanders at the Jasper Ridge Biological Preserve in the early 1980s. All attempts to locate these populations (indicated in Twitty 1941) indicate that these populations are no longer in existence.

2.4.4 Western pond turtle

Description. Western pond turtles are freshwater turtles with carapaces measuring 4 to 7 inches in length when fully grown. Generally, they are olive, dark brown, or blackish in color, with a network of dashes of brown or black that radiate outwards from the centers of their shells. However, shell coloration is highly variable. The ventral color of adults is yellow with patches of brown or black. Seeliger (1945) found juveniles and smaller specimens to be much more irregularly colored. Western pond turtles show little sexual dimorphism, although the male has a more depressed shell than the female.

Natural History. These turtles are wary and secretive. When disturbed, they seek cover in water, diving beneath the surface and hiding in vegetation or beneath submerged rocks and debris. They prefer calm waters with vegetated banks, and typically avoid rapidly running waters. In many locations, western pond turtles move away from creeks during the rainy season, presumably in an effort to avoid being swept away during seasonal flooding. Western pond turtles are omnivorous with a preference for animal matter, although plant material is occasionally eaten. Food includes aquatic plants, fishes, aquatic invertebrates, and carrion. This species is a scavenger and an opportunistic predator with a preference for live prey. The diets of males, females, and juveniles differ in prey size and proportions of food items (Bury 1986). Juveniles in particular appear to be principally carnivorous, shifting to a more omnivorous diet as they mature.

Five to 11 eggs are laid between May and August, in buried nests in sunny areas near water. Hatching time is roughly 73-80 days, after which the 1-inch-long young remain in nests through the winter. Eggs and young are extremely vulnerable to predation (see Threats below). Sexual maturity is believed to be attained after 8 years.

Western pond turtles have been found to feed and reproduce in limited geographic regions of suitable habitat. Daily movements tracked among four turtles near San Simeon averaged between 150 and 250 feet along a stream drainage (Rathbun et al. 1992). Such areas are often inhabited year after year by the same turtles. Juveniles are comparatively sedentary (Bury 1972).

Habitat and Range. Preferred habitat for the pond turtle consists of calm waters such as streams or pools with vegetated banks and basking sites such as logs or rocks, and they may utilize habitat extending as far as 0.25 miles away from water (Rathbun et al. 1992). It has been suggested that two types of nesting sites may be utilized (Storer 1930). Most commonly, eggs are laid in sandy banks adjacent to water. Occasionally, eggs may be laid considerable distances away from water. Nests located out of the flood plain may confer some reproductive advantage in regions that are prone to periodic flooding. Upland habitats are quite important for western pond turtles for wet season refugia and nesting sites (Reese and Welsh 1997).

Records indicate that western pond turtles were historically found from British Columbia to San Diego. The turtles' known range is now considerably decreased. The northwestern subspecies ranges from southern British Columbia south to central California, while the southwestern subspecies ranges northward from extreme southern California to the central portion of the state. The two subspecies intergrade from south of the San Francisco Peninsula region to Kern County (Seeliger 1945).

Threats. Habitat loss and fragmentation are the main threats to western pond turtles. Development in the riparian zone is a significant problem for western pond turtles because of their strong tendency to leave the waterways during periods of high water. Buildings, roads, trails and other human-altered landscapes in areas within several hundred yards of a creek occupied by pond turtles will likely adversely affect turtle survival. Other threats to the turtle include a large number of natural and introduced predators that prey on eggs, hatchlings, and juveniles. Predators include largemouth bass, snakes, wading birds, bald eagles, bullfrogs, black bears, coyotes, otters, and dogs. Raccoons have been cited as a major predator on turtle eggs (Temple 1987). Adult pond turtles are relatively free from predation, and have a long life span. This belief is supported to some degree by findings that the population structure of most turtle populations includes a high percentage of adults (Bury 1972). Dessication of young hatchlings is also believed to be a major mortality factor under hot and dry conditions. Alteration of hydrologic regimes by dams may also threaten western pond turtles (Reese and Welsh 1998). While it is unlikely that people continue to harvest pond turtles for food, it is not uncommon to hear of turtles being picked up during their rainy season wanderings by well meaning people.

Suitable habitat for the pond turtle has been disappearing rapidly as development and construction alters or eliminates the streams and ponds upon which the turtles depend. Direct hunting of turtles for sport or consumption has also played a role in the turtles' decline. Two accounts of turtle trapping for human consumption were included in Storer's 1930 article, which detailed methods used to trap pond turtles and also noted that the turtles commanded "$3 to $6 per dozen and were most in demand about April" (Storer 1930). Trapping or hunting is a particular problem for turtle populations because very few turtles manage to survive long enough to reach sexual maturity.

Western Pond Turtles at Stanford. Western pond turtles are the only native turtles found at Stanford. They are found scattered throughout San Francisquito Creek, from Searsville Dam to the downstream edge of Stanford's boundary (Figure 2-5). In the Jasper Ridge Biological Preserve, they have been historically found along marshier areas of Searsville Reservoir. Western pond turtles were found in Searsville Reservoir through the mid-1990s, but there have been no recent records from the reservoir. Likewise, surveys in creeks and ponded areas upstream from Searsville Reservoir have not documented the presence of western pond turtles in the last 5 years.

The number of turtles, including both western pond turtles and various non-native turtles, present at Felt Reservoir appears to vary considerably from year to year. Stanford Utilities Services and Public Safety staff report that over the last 40 years or so turtles have been irregularly observed at Felt Reservoir. In some years, no turtles are observed; while in other years upwards of 10 turtles have been observed. Biological surveys during the last decade have also found inconsistent numbers of turtles at Felt Reservoir. Some of this variation is undoubtedly due to differences in the observers and to the variable physical factors of the reservoir (mainly the large fluctuations in water level) that make it difficult to see turtles that may be present in the reservoir when it is relatively full.

Non-native turtles are clearly individuals released at or near the reservoir by people who do not realize the biological implications of releasing the turtles. Some of these non-native turtles were probably released directly into Felt Reservoir, and some were probably released elsewhere in the vicinity and subsequently dispersed to the reservoir by their own accord. In recent years, red-eared sliders have been observed in Lagunita (2008), the hotel mitigation ponds constructed at Webb Ranch (2008), and at Jasper Ridge (2006). All three of these records are from areas where it would have been impossible or at least very unlikely for turtles to have been present in the previous year. Additionally, members of the public have reported that two other red-eared sliders were recently released

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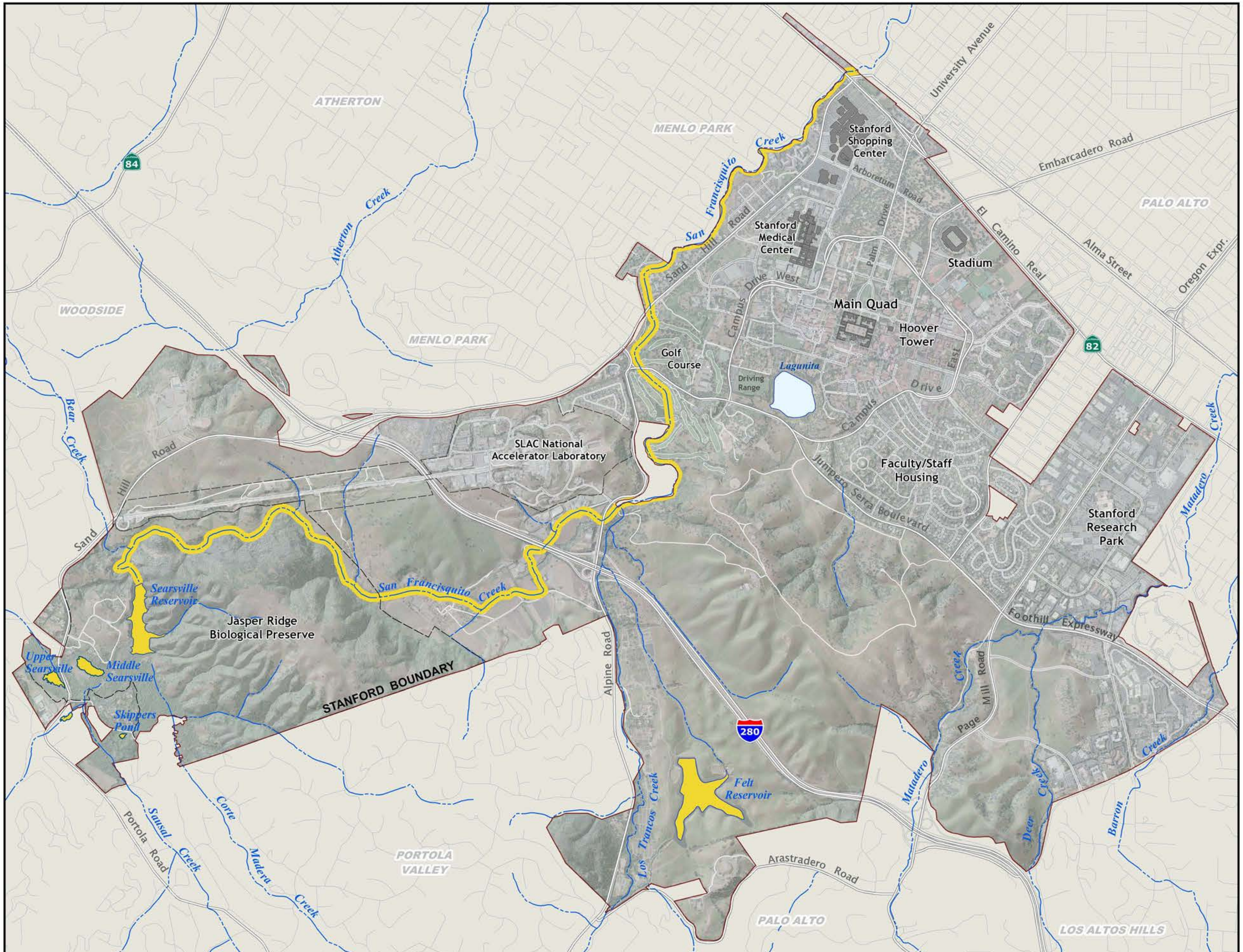


Western Pond Turtle at Stanford

Recently Occupied Creek
(Creek width exaggerated)

Recently Occupied Reservoir

hectare
100
25
4
acres

Sources:
WPT habitat: Stanford Unv. Campus Biologist, 2006
Aerial photos: Aerotopia, 1999
Creeks: US Geological Survey, 1991

Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

N

Stanford University Planning Office
Date Printed: December 2011

Figure 2-5

in Stanford waterways: one each in Skippers Pond and lower San Francisquito Creek.

Western pond turtles present in Felt Reservoir likely include individuals released at the site. There are no areas recently occupied by the species within a distance a pond turtle could reasonably expect to disperse. San Francisquito Creek is approximately 1.1 miles from Felt (at its closest point), but a turtle would need to cross either Alpine Road and Los Trancos Creek, or Highway 280 to go overland directly to Felt Reservoir. The intervening agricultural lands would also make overland dispersal from San Francisquito Creek to Felt Reservoir very unlikely. It is also unlikely that a turtle would disperse upstream in Los Trancos Creek from San Francisquito Creek and then either travel overland for 0.25 miles to the reservoir, or traverse the entire 2.25 miles of Los Trancos Creek on Stanford property then, go down the cement-lined water diversion flume 0.5 miles to Felt Reservoir. Despite annual surveys of the creek since the mid-1990s, there are no records of any turtles in the Stanford portion of Los Trancos Creek.

The highly fluctuating water level, lack of emergent vegetation, and lack of suitable nesting habitat at Felt Reservoir is not conducive to successful turtle reproduction; however, an individual could survive at the reservoir for multiple years. Any western pond turtle that did survive at Felt Reservoir would be isolated from the local population found at San Francisquito Creek.

While no pond turtles have been observed by recent surveys in Matadero and Deer creeks, local residents report that turtles were present in the area, at least through the 1980s. Western pond turtles have not been found at Los Trancos Creek, which provides cool, clear, flowing water that is not typically western pond turtle habitat.

Western pond turtles are occasionally found well away from waterways: along paths and roads at Jasper Ridge, near the Stanford golf course, along Palm Drive, and the Stanford Shopping Center. These specimens are probably either individuals leaving the creek-bed during the beginning of the rainy period (when many turtles apparently take cover in upland areas), or are females looking for places to lay eggs.

Perhaps the greatest threat to western pond turtles at Stanford is human interference, primarily due to habitat loss and human presence near creeks. Female turtles searching for places to lay eggs, in particular, are quite sensitive to interactions with humans and human-built environments, and will retreat to the creek if sufficiently disturbed without laying eggs. The abundance of raccoons, dogs, cats, rats, and other animals associated with suburban development also may be taking a large toll on pond turtles.

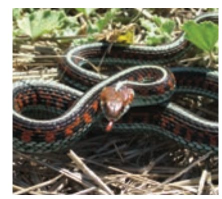
There are no historic quantitative records of turtle abundance or distribution. Therefore, it is unclear whether the local population is stable. The paucity of sightings of adult turtles and nearly complete absence of juvenile turtles strongly implies, however, that the local turtle population is in danger of extinction.

The western pond turtle is not currently protected under the ESA.

Notes. Two subspecies are found in California, the northwestern (*Clemmys marmorata marmorata*) and the southwestern (*Clemmys marmorata pallida*). Distinguishing between the two subspecies is difficult. The northern subspecies has inguinal scutes and a more lightly colored throat than the sides of its head (Pritchard 1979). Seeliger notes that *Clemmys marmorata marmorata* also has a pair of triangular inguinal plates that are larger than the small or even absent inguinal plates of the southern variety. The two subspecies of western pond turtle transition just south of the San Francisco Bay Area. Seeliger lists localities from which intergrades have been examined, including Alameda County, Contra Costa County, and Palo Alto.

2.4.5 San Francisco garter snake

Description. The San Francisco garter snake (*T.s. tetrataenia*) and red-sided garter snake (*T.s. infernalis*) are two distinct subspecies of the common garter snake (*Thamnophis sirtalis*). The San Francisco garter snake is listed as endangered under the ESA. The red-sided garter snake is not a federally listed species. Both subspecies are found on the San Francisco Peninsula.



On the San Francisco Peninsula there is a fairly well documented intergrade zone between the San Francisco garter snake and red-sided garter snake. This intergrade zone is located on the eastern flank of the Santa Cruz Mountains (Barry 1994, Fox 1951). Stanford is within this intergrade zone. The intergrade populations are not considered either the red-sided garter snake subspecies or the San Francisco garter snake subspecies. In this HCP, the San Francisco garter snake, red-sided garter snake, and integrade populations are referred to collectively as "local subspecies" or "garter snakes" (Table 2-1).

Table 2-1 Characteristics of Local Garter Snakes

 San Mateo County © Gary Nafis	**San Francisco garter snakes** have a bright turquoise blue to yellow dorsal stripe, which is bordered on both sides by black stripes. Below the black stripes, there are solid red to orange stripes that are bordered by another pair of black stripes. Below the second black stripes and on the underside, the color is generally the same as the dorsal stripe (turquoise to yellow), but is typically slightly darker. There are often some minor dark or red markings below the second dark stripe. In some individuals the red/orange stripe is partially interrupted by black markings. The interruption of the red/orange stripe is particularly evident at the anterior end of some individuals. The dorsal surface of the head is red to orange. In summary, while there is considerable individual and population-level variation, the basic color pattern of this subspecies is a series of four stripes along each side (a turquoise to yellow dorsal stripe, which is bordered by a black stripe, then a red stripe, which is followed ventrally by a black stripe, with a bluish lower body and underside).
 Marin County © Gary Nafis	**Red-sided garter snakes** have a light turquoise blue to yellow dorsal stripe, which is bordered on both sides by black stripes. Below the black stripes, there are areas of alternating red/orange and black markings, forming red/orange checkered stripes. The red/orange markings are generally square to slightly rounded in shape and slightly larger in width than the black markings. Below these checkered stripes, there is typically no black stripe, and the body color is similar to that of the dorsal stripe, occasionally with darker markings. In some individuals the red markings dominate and nearly form a more-or-less solid red stripe (with minor black markings), particularly along the posterior part of the body. The dorsal surface of the head is red to orange. In summary, the basic color pattern is a series of three stripes along each side of the body (a light turquoise blue to yellow dorsal stripe, which is bordered by a black stripe, which is then bordered ventrally by a red and black checkered stripe, with the lower body and underside bluish in color). There is individual and population-level variation in color pattern.
 Stanford	The color pattern of individuals from **intergrade populations** can be quite variable, but individuals from these populations generally exhibit at least some characteristics of both the San Francisco garter snake and red-sided garter snake. Individuals from intergrade populations can, however, look very similar to either of the two subspecies. The color patterns of intergrade individuals are also often asymmetrical. Populations classified as intergrade do not necessarily include individuals with color patterns that are typically characteristic of either of the two subspecies. Intergradation only implies some mixing of two slightly different gene pools. The mixing could be of recent origin or could be the result of events that happened many generations previously.

In general, populations in the northern portion of the intergrade zone have more individuals that are partially or completely striped, which is more similar to the patterns that are diagnostic of San Francisco garter snakes (Barry 1994). In the southern portion of this zone, which includes Stanford, most of the individuals exhibit the alternating red and black markings that are characteristic of red-sided garter snakes.[3]

Natural History. The local subspecies feed on a wide range of animals, including frogs, salamanders, small fishes, and invertebrates. Small rodents and birds may also be consumed. The San Francisco garter snake is often considered a specialist on ranid frogs, and California red-legged frogs are a major component of the diet of adult snakes in many locations. Juvenile San Francisco garter snakes will prey heavily on Pacific treefrog metamorphs. Prey is usually captured in wetlands, either in the emergent vegetation or in areas of shallow water.

The local subspecies are prey for a number of species, including bullfrogs, large red-legged frogs, snakes, raccoons, dogs, foxes, coyotes, cats, fishes, raptors, herons, and egrets. They can reach 4 feet in length, but most individuals are less than 3 feet in length.

The local subspecies mate in the late winter to early spring, and the young are born in summer to early fall. They are livebearing

[3] It is difficult to determine whether a specific population within an intergrade zone is more closely related to one or the other of the parental subspecies. In the case of the San Francisco/red-sided garter snake intergrade zone this is made more difficult since traditional taxonomic treatments of these snakes rely heavily on color pattern and scale counts – both of which are known to vary within subspecies.

at birth and generally range from 5 to 8 inches in length. Clutch size varies with size of female and year, but generally ranges from eight to 20 young. Females typically bear their young in secluded areas, either hidden in dense vegetation or under some type of cover. In the Bay Area, the local subspecies are generally dormant during the coldest part of winter and may also have a dormancy period during prolonged periods of exceptionally hot and dry weather. The local subspecies generally "hibernate" individually, or in small groups, and not in large numbers, which is typical of other common garter snake subspecies in more northern areas. Their maximum life expectancy is unknown, but it is unlikely that many individuals survive a decade in the wild.

Habitat and Range. The common garter snake is one of the most widely distributed snake species in North America. It is found from coast to coast, from mid-Canada to the Mexican border, being absent from only the most extreme dry and cold areas.

The lack of consensus over the taxonomic status of common garter snake subspecies makes it difficult to identify the range of a particular subspecies. The current view is that San Francisco garter snakes are found on the west-side of the crest of the Santa Cruz Mountains, along virtually the entire coast of San Mateo County, north to San Francisco County. On the coastside, the San Francisco garter snake may stray south into extreme northern Santa Cruz County. East of the crest of the Santa Cruz Mountains, the San Francisco garter snake is found from the City of South San Francisco and the San Francisco airport, south to Crystal Springs Reservoir (all San Mateo County).

Red-sided garter snakes are currently recognized as having a disjunct distribution, with populations being found from coastal Humboldt County south to coastal Monterey County (surrounding the distribution of San Francisco garter snakes). The garter snakes that have been found in Santa Clara County have been identified as red-sided garter snakes.

The red-sided/San Francisco garter snake intergrade zone that includes Stanford is located on the eastern flank of the Santa Cruz Mountains, extending approximately 12 miles from the vicinity of Boronda Lake in Palo Alto (Foothills Park) to Upper Crystal Springs Reservoir (Barry 1994, Fox 1951).

Populations of the local subspecies are typically associated with permanent or nearly permanent bodies of water, usually areas of shallow water and heavily vegetated shores. However, they are known to occur, at least temporarily, in grassland, riparian woodland, oak woodland, and coniferous forest. Sag ponds in the San Andreas Fault rift zone and freshwater coastal marshes are considered prime habitat for the San Francisco subspecies.

Threats. Natural threats include predation by fishes, snakes, birds, and mammals. However, loss of habitat and the subsequent isolation of formerly interacting populations are the most problematic factors on the San Francisco Peninsula. Urbanization of the eastern flank and bay shore portions of the Peninsula, in particular, has been pervasive and many snake populations have been lost. Those surviving individuals and populations face an array of human-related threats, including being killed on roads, trapped in drains/sewers, poisoned by biocides or pollutants, or any of a myriad of other factors associated with the built environment.

Overcollecting may also be a threat, particularly for the San Francisco garter snake. Garter snakes are relatively easy to maintain in captivity and are very popular as pets. Given the vibrant color of the San Francisco garter snake and the allure of keeping a rare specimen, these snakes have been collected, illegally since 1967, for the pet trade for decades.

The large number of captive specimens also presents another problem for the conservation of the subspecies. The release of specimens from captive bred lineages could be problematic for several reasons, including having a genetic make-up not typical of wild stocks (captive breeding invariably introduces an element of artificial selection or genetic drift) or by transmitting disease.

Garter snakes at Stanford. Stanford is within the southern portion of the red-sided/San Francisco garter snake intergrade zone. As such, the intergrade populations found at Stanford exhibit color patterns that are generally more characteristic of red-sided garter snakes.

The intergrade populations have been studied at Stanford and the vicinity sporadically for nearly 100 years. At the present time, the common garter snake is infrequently encountered at Stanford. A few individuals are encountered at Lagunita every year, but specimens from other locations at Stanford are only very infrequently observed. Given the number of museum records and mentions in the scientific literature, it is likely that historically the intergrade populations were more common in the area.

A 1994 study of 47 snakes found in the Palo Alto area, which included Lagunita and areas near San Francisquito Creek, found that approximately 20 percent of the 47 snakes exhibited a red-sided garter snake color pattern and the remaining, approximately 80 percent, exhibited an intergrade color pattern (Barry 1994). An additional 12 snakes that the study observed just south of Stanford, at Boronda Lake in Foothills Park in Palo Alto, all exhibited a red-sided garter snake color pattern (Barry 1994). The results of this study, therefore, indicate that based on color patterns, the integrade population (or populations) at Stanford have a color pattern that is more similar to the red-sided garter snake than to the San Francisco garter snake.

This conclusion is further supported by California Academy of Science specimens as noted in a 1981 study of 35 individual snakes collected at and near Stanford (Seib and Papenfuss 1981). The museum records classified 18 as red-sided garter snakes, 16 as having an intergrade color pattern, and one as a San Francisco garter snake.

On Stanford lands in southern San Mateo County the taxonomic status of the local subspecies is less clear. Stanford and other researchers have repeatedly surveyed areas near Sand Hill Road and Highway 280 for red-legged frogs and San Francisco garter snakes. These surveys were done at the SLAC National Accelerator Laboratory (SLAC) and the nearby former Christmas tree farm (Barry 1976, Balgooyen 1981, Seib and Papenfuss 1981, Westphal et al. 1998, Launer 2006). With the exception of one intergrade individual captured in 1981 in a drainage near the main SLAC accelerator building, no snakes were observed during any of these surveys.

Although garter snakes have not been observed in the vicinity of San Francisquito Creek or Searsville Reservoir, those areas provide potential habitat. Garter snakes have not been found at Los Trancos Creek, which provides cool, clear, flowing water that is not typically garter snake habitat.

Additionally, extensive environmental work on property immediately north of Stanford did not find any local subspecies (H.T. Harvey and Associates 2001, Wagstaff and Associates 2002). In 2007, however, two intergrade individuals were found in Woodside, at a site less than a mile north of Stanford (Swaim Biological 2007).[4]

Notes. Populations found in an intergrade zone generally include individuals exhibiting a range of color patterns and frequently, but not always, include individuals with physical characteristics of one or both of the two subspecies. In order to assign a population with variation to one of the two subspecies, the variation would need to be quantified, which requires an adequate sample size and knowledge of the genetic basis and linkage of the traits being used for the analysis. Since there is considerable variation in populations, such an analysis would also require a known non-intergrade population. Subspecies determinations based on a single or few specimens are scientifically invalid. Genetic analyses may be helpful in determining the "relatedness" of a series of populations and might aid in the clarification of subspecies determinations.

Thus, one of the key problems to answering questions concerning whether the intergrade populations are more closely related to the red-sided garter snake or San Francisco garter snake is that at the present time neither of the two subspecies are commonly found in most locations. This is problematic because a large sample size is necessary in order to determine the precise genetic make-up of the local population (Amadon 1949, Cicero and Johnson 2006, Mayr 1942, Rand 1948). Additionally, while molecular-level analyses with small sample sizes may be able to address some questions pertaining to population-level relationships, if significant variation is present, they too will need to have a sufficient number of specimens in order to resolve many taxonomic ambiguities.

Moreover, the legal status of the intergrade form currently is not clear. The San Francisco garter snake was listed as endangered by the Service in 1967.[5] However, the ESA listing does not specifically include the intergrade form as a protected form of the San Francisco garter snake subspecies, and the Service has not adopted final regulations clarifying the status of the intergrade populations.

Because of the uncertain legal status of the intergrade populations, difficulties in discerning whether a specific population within the intergrade zone is more closely related to the federally listed San Francisco subspecies or the non-listed red-sided subspecies, and the lack of definitive genetic information, the San Francisco garter snake has been included in this HCP. As such, the HCP will protect all garter snakes found at Stanford, regardless of their ultimate taxonomic or legal classification.

[4] From the photographs provided, the two specimens from the Woodside site appear to be an intergrade form of red-sided and San Francisco garter snakes. Further specimens were reportedly captured at this site in 2008, but no information about these specimens is available.

[5] It is also a Fully Protected species under the California Endangered Species Act (CESA). Under the CESA, the CDFG cannot authorize the lethal take of a Fully Protected species. To avoid any inconsistencies with State law, Stanford is not seeking a federal incidental take permit that would allow lethal take of the San Francisco garter snake.

SECTION 3
COVERED ACTIVITIES
AND THEIR IMPACTS

3.0 COVERED ACTIVITIES AND THEIR IMPACTS

As part of the HCP, Stanford is seeking a Section 10(a) incidental take permit from the Service and NOAA Fisheries. An incidental take permit can be issued for one-time site-specific activities or projects, or for a broader program of multiple ongoing or annual maintenance activities. Stanford is seeking the latter type of incidental take permits that will allow it to operate and develop the University, and perform the Covered Activities described below.

This section describes the Covered Activities that Stanford routinely performs, including the construction of new facilities. **All of the activities described below are Covered Activities, unless the HCP specifically excludes them from coverage.** The Covered Activities include activities related to water management, academic uses, maintenance and construction of urban infrastructure, recreational and athletic uses, general campus management and maintenance, activities that are carried out by Stanford's tenants, and future development. All of these activities are necessary to keep the University operating, and most of these activities have been ongoing for many years. These activities represent the type of University operations that could affect the Covered Species, and allow the University to analyze the potential effect of its operations on the Covered Species. But, because of the size and diversity of operations, and the changes in technology that are continually occurring, it is not possible to describe all of the University's actions in complete detail. Therefore, the discussion of impacts on the Covered Species by the Covered Activities is addressed qualitatively in this section. The cumulative effect of these activities, with the implementation of the HCP's Conservation Program, are then quantitatively assessed in Section 5.3 of the HCP. Section 4.0 of the HCP describes the Conservation Program that will avoid or minimize the take of Covered Species caused by the Covered Activities.

This section describes many activities that individually present a very low chance of causing take of Covered Species. When viewed cumulatively, however, these common activities likely would result in take, and if this take were not minimized or mitigated for, it could, over time, have a potentially significant effect on the Covered Species. The HCP is designed to benefit the Covered Species and increase the likelihood of their persistence at Stanford. If the HCP is successful, the Covered Species populations at Stanford will increase, and, as the Covered Species become more abundant, they will inhabit more areas at Stanford. Although this will provide a significant benefit to the Covered Species, the number of individuals of the Covered Species that are taken, particularly while conducting routine activities could increase when the Covered Species start inhabiting areas that are currently uninhabited. The percentage of the local populations impacted, however, will remain the same or will decrease as the overall population of Covered Species continues to increase. Therefore, while any one of the Covered Activities, at any given time, may not result in the take of Covered Species, the activities are all considered Covered Activities because, on a cumulative basis, they could result in take.

3.1 LOCAL WATER FACILITIES

Stanford University uses both potable and non-potable water. The San Francisco Public Utilities Commission Water Department (SFPUC) supplies Stanford with potable water and Stanford operates and maintains potable water-related infrastructure. Stanford also operates and maintains groundwater wells that are routinely monitored and are of potable-water quality.

The non-potable water supply currently is used mainly for irrigation and as a backup to potable water for fire protection. Water diversions from Los Trancos Creek, San Francisquito Creek, and Searsville Reservoir each independently supply Stanford with non-potable water[1] and the wells also occasionally supplement this water supply. Non-potable water is stored in Felt Reservoir and Searsville Reservoir (Figure 3-1). Searsville Dam and Reservoir, and operations and maintenance activities at Searsville, are not Covered Activities and are therefore not described below.

Stanford Utilities Services is responsible for the planning, operation, and maintenance of the potable and non-potable water supply systems, chilled water/steam system, and the sanitary sewer and storm drainage systems. These systems include many components, such as water diversion facilities; creek monitoring devices; dams; reservoirs; deep wells; over 200 miles of water, sewer and drainage piping; open channels; fire hydrants; manholes; and meters. All of these water management facilities and activities are needed to support academic research and a daily campus population of about 30,000 people.

3.1.1 Water Diversions

Stanford University holds and exercises riparian and pre- and post-1914 appropriative water rights and licenses for the Los Trancos diversion located on Los Trancos Creek and a pump station[2] on San Francisquito Creek at the Stanford golf course (Figure 3-1). Felt Reservoir is the largest storage reservoir at Stanford.

Operation of Los Trancos Creek Diversion. Water from Los Trancos Creek is diverted by an in-stream structure located on Los Trancos Creek just downstream from the Stanford property boundary near Arastradero Road. The Los Trancos Creek

[1] The diversion from Los Trancos Creek, the diversion from Searsville, and the diversion from San Francisquito Creek are all separate water supply diversions, and are operated independently and can each supply Stanford with non-potable water.

[2] There are two sets of pumps on San Francisquito Creek; these are referred to as the Felt pumps and the Lagunita pumps, and are combined into one facility.

diversion facility includes a small diversion dam, a by-pass channel/fish ladder, screen, and a concrete-lined conveyance channel (flume). From this structure, the water is contained in the flume and flows by gravity to Felt Reservoir. To facilitate fish passage the structure was modified in the mid-1990s, using a design provided by the CDFG. The modified structure improved fish passage and helped prevent the diversion of fish into the conveyance flume. However, that fish ladder and screen were highly labor intensive, negatively affected diversion operations, and resulted in a reduction in the amount of water that can be diverted from Los Trancos Creek to Felt Reservoir, particularly during high flows.

Stanford, in consultation with NOAA Fisheries and the CDFG, studied ways to enhance conditions for steelhead through improvements to the water diversion facilities. The structural modifications and operational changes to the Los Trancos Creek and San Francisquito Creek pump station diversions, and accompanying maintenance to restore storage capacity at the Felt Reservoir, are known as the Steelhead Habitat Enhancement Project (SHEP). The design for the proposed modifications and operating protocols for the SHEP were finalized by Stanford, in consultation with the CDFG, and NOAA Fisheries. NOAA Fisheries issued a Biological Opinion to the US Army Corps of Engineers for the project in April 2008 and CDFG issued a 1602 Lake and Streambed Alteration Agreement (SAA) in September 2008 (Appendix A). Construction of the SHEP was completed in October 2009. Operation of the diversion since that time has been in accordance with the SHEP agreement. The new protocols substantially increase flows through the fish ladder, which enhance conditions for steelhead migration and spawning. These enhancements also will accommodate the upstream and downstream movement of juvenile steelhead.

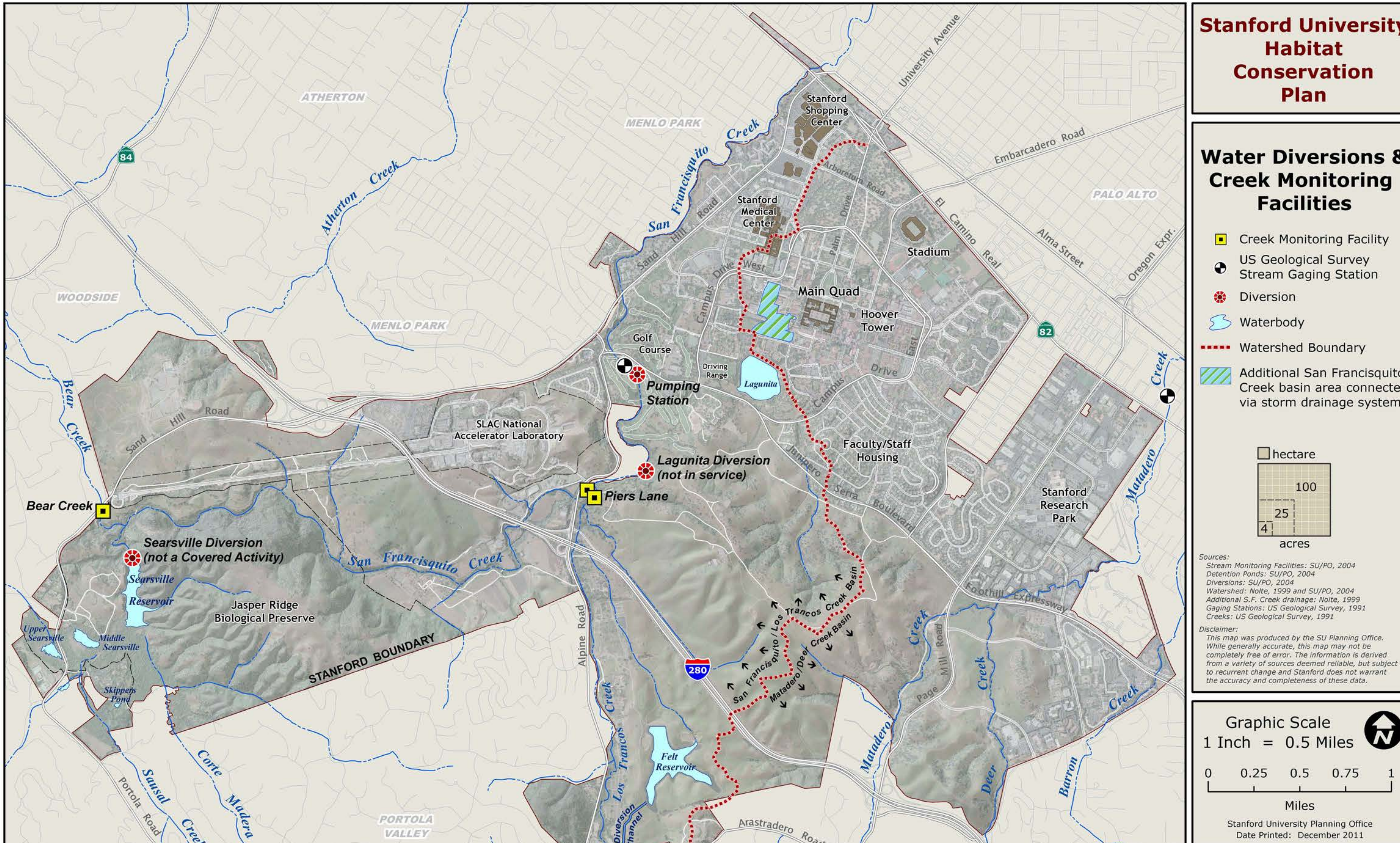
Operation of San Francisquito Creek Pump Station. Stanford has operated a water diversion in San Francisquito Creek near the Stanford golf course for more than 100 years. Although the diversion is located adjacent to the golf course, it is unrelated to the operation of the golf course. In February 1986, the diversion was moved from the currently non-operating in-stream Lagunita diversion downstream to its present location because of extensive collapsing of the flume. It was configured with an in-stream weir and pumping facilities with perforated pipe intakes that are essentially at-grade. In 1998, under permits from Santa Clara Valley Water District, CDFG, and Santa Clara County, the station was completely reconstructed and now consists of an infiltration gallery and two sets of subsurface pumps: the Lagunita pumps, which convey water to Lagunita through a flume, and the Felt pumps, which convey water to the pipeline that extends from Felt Reservoir to campus. Both sets of pumps are located in a single pump station facility. One purpose of the Felt pumps is to pick up the Los Trancos Creek water bypassed at the fish ladder facility. The losses at Los Trancos have not been consistently made up by the San Francisquito Creek pump station for various reasons, including limited pump capacity. The SHEP included structural modifications and operational changes to this diversion facility which, as described above, were in place in October 2009 and provide enhanced steelhead habitat and downstream passage.

Construction of the two modified diversion facilities and the accompanying sediment removal to restore storage capacity at the Felt Reservoir were permitted by NOAA Fisheries, CDFG and various other federal, state, and local agencies separately and therefore are not Covered Activities under this HCP.

The physical presence of the Los Trancos diversion and San Francisquito Creek pump station, ongoing operation of the facilities as approved under the SHEP, and the future maintenance of these facilities are Covered Activities under this HCP.

Maintenance of the Los Trancos Creek Diversion Facility. Maintenance of the Los Trancos Creek diversion facility consists of activities both during the diversion season and the off-season. Diversion season maintenance includes occasional repair of the fish screen brush mechanism, frequent clearing of accumulated gravel and debris from all of the flow paths (radial gate, ladder, bypass channel and flume), and occasional repair of the gate mechanism. Generally, high creek flows trigger the need for this maintenance work. For safety reasons, all of this work is done after high creek flows (when problems typically occur) have subsided, and there is minimum disturbance to creek flow. These activities usually take a few hours, and usually occur several times each diversion season. When necessary to facilitate maintenance activities in the ladder and bypass channel, the creek flow is temporarily rerouted through the opened radial gate; no coffer dams or piping of creek flow is necessary for this routine maintenance.

Maintenance of the San Francisquito Creek Pump Station. Maintenance of the San Francisquito Creek pump station involves much less invasive activity than maintenance of the Los Trancos Creek diversion facility because of the pump station's configuration. Pump station maintenance activities consist primarily of backwashing of the infiltration gallery and piping with water, and pump repairs. Backwashing of the gallery involves periodic (up to daily, depending on operations and creek



Stanford University Habitat Conservation Plan
Water Diversions & Creek Monitoring Facilities
Creek Monitoring Facility
US Geological Survey Stream Gaging Station
Diversion
Waterbody
Watershed Boundary
Additional San Francisquito Creek basin area connected via storm drainage system
hectare
100
25
4
acres
Sources:
Stream Monitoring Facilities: SU/PO, 2004
Detention Ponds: SU/PO, 2004
Diversions: SU/PO, 2004
Watershed: Nolte, 1999 and SU/PO, 2004
Additional S.F. Creek drainage: Nolte, 1999
Gaging Stations: US Geological Survey, 1991
Creeks: US Geological Survey, 1991
Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.
Graphic Scale
1 Inch = 0.5 Miles
0 0.25 0.5 0.75 1
Miles
Stanford University Planning Office
Date Printed: December 2011
ATHERTON
MENLO PARK
WOODSIDE
PALO ALTO
PORTOLA VALLEY
LOS ALTOS HILLS
Atherton Creek
San Francisquito Creek
Bear Creek
Sand Hill Road
Stanford Shopping Center
Stanford Medical Center
University Avenue
Embarcadero Road
Arboretum Road
El Camino Real
Alma Street
Oregon Expr.
Stadium
Main Quad
Hoover Tower
Golf Course
Driving Range
Lagunita
Pumping Station
SLAC National Accelerator Laboratory
Lagunita Diversion (not in service)
Piers Lane
Faculty/Staff Housing
Junipero Serra Boulevard
Stanford Research Park
Matadero Creek
Bear Creek
Searsville Diversion (not a Covered Activity)
Searsville Reservoir
Jasper Ridge Biological Preserve
Upper Searsville
Middle Searsville
Skippers Pond
STANFORD BOUNDARY
Alpine Road
280
Los Trancos Creek
Felt Reservoir
San Francisquito / Los Trancos Creek Basin
Matadero/Deer Creek Basin
Foothill Expressway
Page Mill Road
Deer Creek
Barron Creek
Arastradero Road
Diversion Channel
Los Trancos Diversion
Sausal Creek
Corte Madera Creek
Portola Road
84
82

Figure 3-1

sediment conditions) valve exercising (opening and closing) in the piping near the top of bank, and agitation of accumulated sediments above the gallery in the creek. During routine pump servicing, the out-of-water top of the vault is simply opened and work can proceed with no direct contact with the creek.

Repair of the pumps is typically performed in the summer low-flow periods; however, in rare emergencies, the pumps in the vaults may need to be accessed for repair/removal during the diversion season. If extensive maintenance is required, the adjacent creek is blocked off from the vault area by seines and cleared of fishes before workers enter the vault area. This is rarely needed and is done on average once every 20 years and affects an area approximately 50 feet in length.

3.1.1.1 Potential Effects of the Water Diversions on the Covered Species

Stanford's San Francisquito Creek pump station and Los Trancos Creek diversion facility were modernized during the 1990s and again in 2009 to protect steelhead. Physical and operational changes were made at these times. The physical changes to these two facilities included the installation of fish screens and ladders. These physical changes and changes in the operation of the San Francisquito Creek pump station and Los Trancos Creek diversion facility have significantly reduced the effects of the water diversions on the Covered Species. However, the operation of these diversions may still result in the incidental take of steelhead.

Operation of the Los Trancos Diversion. On April 21, 2008, NOAA Fisheries issued a Biological Opinion and Incidental Take Statement for the SHEP (Appendix A). This Biological Opinion evaluated the effects on steelhead and impacts to designated Critical Habitat of constructing, operating, and maintaining the SHEP facilities. The Biological Opinion found that the SHEP will result in minor and short-term adverse effects to steelhead and Critical Habitat during construction, and that the long-term effects of the SHEP are beneficial to steelhead and designated Critical Habitat by largely eliminating the impacts of Stanford's water diversions on stream flows that are important to steelhead (Appendix A at pgs. 38-39). The SHEP included modifications to the design of the fish ladder and fish screen that more efficiently divert water during periods of high flows. The new fishway was also designed to comply with current CDFG and NOAA Fisheries criteria for anadromous fish passage. By increasing diversions during high flow periods, Stanford will have greater flexibility to increase bypass flows during low-flow periods. This flexibility, along with an improved fishway, will enhance creek conditions for steelhead during both low- and high-flow periods. The effects of the diversion operation on steelhead have been described in the SHEP Biological Opinion and in the SAA.

However, take of steelhead would occur; thus, the presence, operation, and maintenance of the Los Trancos Creek diversion facility are covered under this HCP.[3] NOAA Fisheries' Biological Opinion and Incidental Take Statement to the Corps on April 21, 2008 sets a limit on the amount of take that is authorized and imposes reasonable and prudent measures and terms and conditions that NOAA believed were necessary and appropriate to minimize take of steelhead (Appendix A at pgs. 39-46). As part of the HCP's conservation program, Stanford's long-term operation of this facility will continue to be as described in the SHEP. As a Covered Activity in this HCP, Stanford requests that the NOAA Fisheries incidental take permit include the long-term operation of the Los Trancos diversion facility.

California tiger salamanders do not occupy the diversion site or any downstream reaches. Operation of the diversion facility therefore does not affect them. Garter snakes and western pond turtles do not occupy the diversion site, but may be found in the downstream reaches of the creek. California red-legged frogs may use Los Trancos as a dispersal corridor. The operation of the Los Trancos diversion results in changes to downstream water flows. This does not affect any of these Covered Species because the volume of diversion is small relative to the creek flows.

Operation of the San Francisquito Creek Pump Station. The San Francisquito Creek pump station has been modified to divert the additional bypass flows at the modified Los Trancos diversion. As part of the SHEP, the Felt pumps were modified so that they can accommodate up to 8 cfs, an increase of 4 cfs over the current 4 cfs rate (Appendix A). The Lagunita pumps were not changed. The SHEP included modifications to the protocols for operating the modified pump station. The modified protocols will improve creek conditions for steelhead passage.

However, take of steelhead would occur; thus, the presence, operation, and maintenance of the San Francisquito Creek pump station diversion facility are covered under this HCP. NOAA Fisheries' Biological Opinion and Incidental Take

[3] Take of steelhead from the presence, operation, and maintenance of the modified facilities also will be addressed in the Biological Opinion prepared by NOAA Fisheries as part of the review and permitting of this HCP.

Statement issued to the Corps for the SHEP sets a limit on the amount of take that is authorized and imposes reasonable and prudent measures and terms and conditions that NOAA believed were necessary and appropriate to minimize take of steelhead (Appendix A at pgs. 39-46). As part of the HCP, Stanford's long-term operation of this facility will comply with the Incidental Take Statement issued by NOAA Fisheries and the SAA with CDFG for the SHEP. As part of the HCP's conservation program, Stanford's long-term operation of the San Francisquito Creek pump station will continue to be as described in the SHEP. As a Covered Activity in this HCP, Stanford requests that the NOAA Fisheries incidental take permit include the long-term operation of the San Francisquito Creek pump station. Operation of the San Francisquito Creek diversion does not affect California tiger salamanders because this species is not found at the diversion site or in areas downstream, and these areas do not provide suitable tiger salamander habitat. California red-legged frogs, garter snakes, or western pond turtles have not been observed at this location for at least a decade. However, the area does provide potential habitat for these species and they may intermittently occupy the area in the future. The operation of the pumps will not impinge or entrain these species. Because of the flashy nature (i.e., often rapidly fluctuating flow level) of the creek, the manipulation of water levels caused by the diversions will not affect western pond turtles, red-legged frogs, or garter snakes that may infrequently inhabit downstream areas.

Maintenance of the Diversion Structures. The maintenance activities associated with the current diversion facilities could have short-term adverse effects on the Covered Species, particularly steelhead. Maintenance of the diversion structures involves work in the creeks, though this work typically occurs during the summer or fall, when the creeks are low or dry. Maintenance occasionally requires isolating a short portion of the creek affected by the work with coffer dams and temporarily confining flows to a short length of pipe.

Maintenance of the Los Trancos Diversion. California tiger salamanders, garter snakes and western pond turtles do not occupy the Los Trancos diversion site. Maintenance of the diversion facility therefore does not affect them. California red-legged frogs may use Los Trancos as a dispersal corridor. Maintenance of the diversion facility could affect California red-legged frogs. Red-legged frogs could be adversely affected by maintenance workers and equipment. The effects of the diversion maintenance on steelhead have been described in the Biological Opinion for the SHEP issued to the Corps in April 2008 and in the SAA (Appendix A).

Maintenance of the San Francisquito Creek Pump Station. Maintenance of the San Francisquito Creek diversion does not affect California tiger salamanders because this species is not found at the diversion site, and this area does not provide suitable tiger salamander habitat. California red-legged frogs, garter snakes, or western pond turtles have not been observed at this location for at least a decade. However, the area does provide potential habitat for these species and they may intermittently occupy the area in the future. Maintenance workers and equipment could adversely affect these species.

Maintenance activities associated with the facility could produce short-term impacts to steelhead when steelhead are excluded or moved from the area of the station, or with a change in water quality as sediments are stirred up during maintenance activities. The effects of the diversion maintenance on steelhead have been described in the Biological Opinion for the SHEP issued to the Corps in April 2008 and in the SAA (Appendix A).

3.1.2 Creek Monitoring Facilities

Two semi-automated water quality and sediment monitoring devices were installed by the City of Palo Alto in 2002 in the San Francisquito watershed on: (1) Los Trancos Creek (at Piers Lane), and (2) San Francisquito Creek (at Piers Lane) (Figure 3-1). The equipment was installed by, and continues to be owned by, the City of Palo Alto. The stations are operated by Stanford as part of the San Francisquito Watershed Council's Long-Term Monitoring and Assessment Program (LTMAP).

Equipment at each of the stations is mounted on a 4.5' x 4.5' concrete pad located near the top of bank. Cables extend from the automated equipment into the creek for the purpose of continuous monitoring of factors such as pH levels and temperature. Flexible Teflon tubing extends from the equipment into the stream and draws water quality samples at a frequency of six times per year. These samples are collected and transported to local laboratories for more thorough water quality analysis and testing. Strainers are installed on the tubing to prevent vegetation, fish, or invertebrates from being trapped in the tubing. Samples are drawn at varying flow rates throughout the rainy season.

The tubing, cables, and probes that extend into the stream are occasionally damaged by high-flows. These are replaced during low-flow periods as needed, which is generally once per year.

A third monitoring device, which is operated by the City of Palo Alto and therefore not covered by the HCP, is located on lower San Francisquito Creek at Newell Road. In 2004, as part of the LTMAP and to provide additional data from the San Francisquito Creek watershed, Stanford installed an additional monitoring station on Bear Creek, downstream from Sand Hill Road in Stanford's Jasper Ridge Biological Preserve. Stanford also maintains a stream flow and sediment transport gauge on Corte Madera Creek at Westridge Drive. This site is not on Stanford's property, but is operated by the University.

3.1.2.1 Potential Effects of the Creek Monitoring Facilities on the Covered Species

The presence and operation of the water quality and sediment monitoring devices will not affect any of the Covered Species.

These facilities extend minimally into the creeks (only probes to collect water quality samples and data are located in the channels) and will not trap individual steelhead during water sampling, or inhibit their dispersal.

Maintenance of these facilities could affect steelhead and red-legged frogs. Steelhead and frogs frequently hide under in-stream objects, including pipes and tubes, and are found in the vicinity of the creek monitoring devices. Although unlikely, workers repairing these facilities could therefore inadvertently disturb an individual steelhead and frog. However, such impacts would not have any long-term effects on steelhead or frogs. None of the other Covered Species are expected to be encountered during maintenance of the creek monitoring facilities because they would be unlikely to be hiding under in-stream objects.

3.1.3 Open-Water Reservoirs

Stanford maintains Felt Reservoir and Lagunita (Figure 3-1).

Felt Reservoir (DWR # 614-002; National ID# CA00670). The storage capacity at Felt Reservoir is approximately 1,050 acre-feet (341,250,000 gallons), and the current dam was completed in 1930. The earthen berm is 67 feet tall and 590 feet in length. Felt Reservoir is an off-channel reservoir located in the lower foothills between Highway 280 and Alpine Road, in Santa Clara County (Figure 3-1). The surrounding land is rolling grasslands that are used for livestock grazing. Felt Reservoir is a manmade water storage basin and it is filled primarily from the Los Trancos Creek diversion; however, some water is also supplied by the pumping station on San Francisquito Creek (located at the Stanford golf course) and Searsville Reservoir. A booster pumping station was constructed in 2004 on a water system pipeline approximately 2 miles below Searsville Reservoir, which allows water from Searsville Reservoir to be moved to Felt Reservoir for storage and distribution. The San Francisquito Creek pump station contains a pair of pumps that can convey up to 8 cfs of water from San Francisquito Creek to Felt Reservoir.

In 2008, the historic capacity of Felt Reservoir was restored by the removal of approximately 150,000 cubic yards of accumulated sediment, which was then placed as compacted fill on the areas surrounding the reservoir. Prior to this excavation, the reservoir's capacity was approximately 937 acre feet. The Felt Reservoir Capacity Restoration Project was permitted by the state, federal, and local agencies as part of the SHEP facility improvements in 2008 (Appendix A).

Stanford is required by the California Division of Safety of Dams to control rodent activity on the dam to preserve structural integrity. Rodent abatement takes place as needed, using County, State, and federally approved control methods. The reservoir and dam are annually cleaned to remove accumulated debris and function-impacting plant growth. The valves and pipes are subject to annual blow-off testing. Minor repairs to the dam structure are conducted as needed. It is anticipated that within the term of this HCP, sediment will have to be removed from Felt Reservoir again to retain the reservoir's operating capacity. Sediment removal in Felt Reservoir will occur in the dry season, when the water level is low (i.e., approximately 20 percent of reservoir's capacity of water is present), and areas requiring sediment removal are exposed. Backhoes and other heavy equipment will be used to remove and relocate sediment.

Lagunita (DWR #614-003; National ID# CA00671). Lagunita is an off-channel seasonal reservoir that was created in the late 1870s as a stock pond and water-holding facility for Leland Stanford's Palo Alto Stock Farm and vineyard. The earthen berm is 16 feet tall and 2,500 feet in length. It is located in the developed portion of the campus, just to the north of Junipero Serra Boulevard. The University's main campus borders Lagunita on three sides, and Junipero Serra Boulevard separates Lagunita from the lower foothills.

In most years, Lagunita partially fills with rainwater runoff during the winter. The runoff amount varies widely with the amount and intensity of rainfall. The Lagunita lakebed and berm are permeable (losing an estimated 500 gallons a minute to percolation), and in order for Lagunita to hold water for more than a few weeks at a time, and provide suitable California tiger salamander breeding habitat, water needs to be added. Historically, in most years of above average winter rainfall, Stanford added water to Lagunita, usually between mid-March and mid-June. In those wet years that Stanford added supplemental water to Lagunita, the reservoir was filled to the desired water level by late March and water levels were typically maintained through University commencement (mid-June). Managed water levels have varied considerably over the last 100 years, depending on water availability in San Francisquito Creek, projected use of Lagunita, and functioning of the di-

version system and storage facility. In years that Lagunita is supplemented with creek water, the reservoir will typically retain water for approximately 1 month after the addition of water ceases and will be dry by late July. Even in years with exceptionally high rainfall, Lagunita dries by late spring or early summer without supplemental water, and in most years it would be dry by May without the addition of supplemental water. During years with below average rainfall (or during years when the timing of storms resulted in a lower than average creek flow), Lagunita is often dry in late January.

Stanford will continue to manage Lagunita water levels to support California tiger salamander reproduction. Specifically, Stanford will operate its water systems to maintain a depth of 3 to 5 feet at the drain during the period of tiger salamander early larval development (generally February to early May), if the monitoring surveys indicate that California tiger salamander breeding has occurred in Lagunita. Starting in mid-May, Stanford will manage the water levels at Lagunita in a manner that mimics natural conditions (e.g., water levels will be gradually reduced to mimic natural drying, with Lagunita becoming dry by the end of June to early July). The newly created ponds in the foothills will be used as one index of natural conditions. Stanford anticipates implementing the following operations plan to accomplish this:

1. During years where rains have allowed the accumulated storm water runoff in Lagunita of 3 feet on the staff plate, elevation 122' above Mean Sea Level (MSL) on January 15, Stanford will operate the Lagunita diversion at San Francisquito Creek, or otherwise convey water (i.e., well water or reclaimed water, but Stanford will not use treated domestic, potable water for this use) to Lagunita, at a rate adequate to maintain the water level in Lagunita at an elevation of 124 +/- 1 foot, which places the water surface near the toe of the berm on the northeast side. (Note that late season storm events may cause the reservoir level to temporarily rise above the managed level of 124 feet.) At the managed elevation of 124 feet, the water covers a surface area of approximately 16 acres, 8 acres of which are at a depth of 0 to 2 feet and another 8 acres are at a depth between 2 and 4 feet; a few hundred square feet near the drain will have a depth greater than 4 feet. In years where there is normal or above rain fall, the water level in Lagunita will generally stabilize at 126 foot above MSL. At this level the reservoir covers approximately 20 acres, of which 4 acres are 0 to 2 feet deep, 8 acres are 2 to 4 feet deep, and approximately 8 acres are more than 4 feet deep. The diversion of creek water to Lagunita will be implemented only if: 1) the Lagunita diversion facilities are safe and operational, 2) there is sufficient water available in San Francisquito Creek at the point of diversion and water diversions to Lagunita are not in significant conflict with other environmental considerations, 3) there are not overriding public safety and health concerns raised by governmental agencies associated with water in Lagunita, and 4) Lagunita is considered critically important to the local persistence of the California tiger salamander. The diversion of creek water to Lagunita will continue only as long as these conditions remain met, or until the following two conditions are triggered.

2. On April 1 of each year, the flow of San Francisquito Creek and status of California tiger salamanders in and around Lagunita will be assessed, and Stanford will exercise professional judgment whether to continue, reduce, or cease diversions to Lagunita. If California tiger salamanders are present and creek water is available (relative to the operating parameters of the diversion system and potentially competing environmental concerns), the diversion rate will not be reduced from what is necessary to maintain the 124+/-1-foot level unless it is deemed appropriate for California tiger salamander management. A constant inflow of relatively cool creek water can act to retard California tiger salamanders larval development. It is likely that in some years it will be desirable for the salamanders to lower the water level in mid-spring to 122 ft +/- 1 ft above MSL. This lower level would result in slightly warmer water in Lagunita, which would still cover approximately 8 acres with several feet of water. This controlled lowering mimics the drying of natural bodies of water occupied by California tiger salamanders. While not expected, overriding public safety and health concerns raised by governmental agencies associated with water in Lagunita could require the cessation of diversion.

3. In the late spring/early summer, Stanford will cease diversions from San Francisquito Creek to Lagunita, and the water level at Lagunita will be allowed to drop naturally through percolation, evaporation, and transpiration. The diversions may be extended if California tiger salamanders development is not sufficiently advanced, and there is adequate water in San Francisquito Creek.

The berm that surrounds Lagunita is maintained with a Bermuda grass cover that is irrigated, fertilized, and mowed so that it maintains a pleasant visual quality throughout the year. In addition, Stanford is required by the California Division of Safety of Dams to control ground squirrel activity on the berm to ensure structural integrity. Ground squirrel abatement takes place as needed using County-approved control methods such as trapping and poison baiting. In the early fall, when Lagunita is dry, the reservoir bottom is mowed for fire control. These activities are all annual maintenance necessities and are Covered Activities, except for the use of poison.

The drain system requires routine maintenance and periodic upgrades. The two drain structures and associated pipes occupy approximately 0.1 percent of Lagunita's surface area. Additionally, the earthen berm occasionally needs minor repair (filling of potholes and removal of dead trees). The berm may need some significant work during the life of the HCP. The amount of permanent land conversion associated with significant berm work would be mitigated in accordance with Section 4.4 of the HCP.

Several maintenance changes have occurred at Lagunita in the last decade in response to the increased concern over California tiger salamanders. Stanford stopped discing the lake bottom in the early fall for fire control because the discing could have adversely affected California tiger salamanders and garter snakes. Instead, Stanford began mowing the reservoir bottom, which has fewer effects on the tiger salamanders and garter snakes. In addition, as discussed in Section 3.6.2 below, two recreational uses of Lagunita were discontinued. Stanford recently modified its diversion facilities to improve their efficiency at various flow levels, which has assisted Stanford in ensuring the availability of water for Lagunita.

3.1.3.1 Potential Effects of Water Reservoirs on the Covered Species

Operation and maintenance of Felt Reservoir will not affect California tiger salamander or steelhead because they are not located at the Reservoir. If the HCP's Conservation Program is successful, the population of California red-legged frogs and garter snakes will increase, and their range will likewise increase and could expand to Felt Reservoir during the life of the HCP. If these species become present at Felt Reservoir, dredging of accumulated sediment with heavy equipment could adversely affect them. Western pond turtles are periodically found in Felt Reservoir. Sediment removal would not affect any turtles that were present because they would follow the water ponding and move away from the dry mud that would be removed. If garter snakes are foraging in the vegetation that grows as the water recedes, the operation of heavy equipment could result in take.

Given the rate of water withdrawal, size of the reservoir, and the screening of the pipe intakes, western pond turtles are not impinged on the water intake screen and could not enter the pipe system. The substantial changes in water level during the year, however, are likely not optimal for turtle growth and survival, and western pond turtles left at Felt Reservoir therefore have a poor chance of long-term survival.

Lagunita provides breeding habitat for California tiger salamanders and the surrounding areas, including the berm, serve as upland habitat. Stanford manages Lagunita primarily for the benefit of California tiger salamanders. The operation of Lagunita likely has few, if any, significant adverse effects on California tiger salamanders because the management regime was specifically designed to benefit California tiger salamanders. However, the routine maintenance of Lagunita could result in the direct take of a small number of California tiger salamanders, or indirect take through habitat modification. Virtually all maintenance activities occur during the dry season and invasive practices, such as drain replacement or repair, are very limited in their extent and time frame.

Garter snakes are also present at Lagunita and vicinity. Operation of the reservoir provides a significant benefit to the species, but mowing in and around Lagunita could adversely affect garter snakes. Since the mid-1990s mowing has been conducted during periods when most, if not all, salamanders and snakes are inactive (during the hottest part of the mid-afternoon) and the mowers are set to cut vegetation no closer than 8 inches from the ground. It is unclear whether the snakes do better, worse, or are indifferent to mowed versus unmowed vegetation.

Maintenance and operation of Lagunita do not affect western pond turtles, California red-legged frogs, or steelhead because none of these species inhabit the seasonal reservoir, and it does not provide suitable habitat for them. However, turtle species other than western pond turtles are occasionally released at Lagunita without Stanford's authorization. In spring 2008, for example, a red-eared slider was repeatedly seen in Lagunita. It is therefore possible that in the future a western pond turtle could be released, without Stanford's authorization, into the reservoir. Lagunita is a seasonally filled reservoir and therefore does not provide suitable habitat for western pond turtles, and any western pond turtle that is subject to an unauthorized release at Lagunita would therefore have a very poor chance of survival.

3.1.4 Distribution System

Underground pipes, water lines that span the creeks on the underside of bridges, and above-ground filters, valves, and pump stations are located in virtually all areas of Stanford University. These were constructed in order to meet the demands of the University and surrounding communities. Maintenance and the upgrading of these facilities occur on a regular basis. New utilities are commonly constructed, in response to changes in the University's needs and to comply with public safety codes. Maintenance of existing lines (mainly excavation and flushing of lines) and the construction of new lines are typically limited to 3- to 6-foot-wide utility corridors, and excavation work typically occurs only in the dry months. However, emergency repairs may be required any time of the year.

Some of the existing pipelines are located very close to the creeks, and there are a number of creek-spanning pipes. Utility work in areas adjacent to the creeks often requires Stanford to remove a substantial amount of vegetation, install coffer dams, temporarily direct the flow of water with a bypass pipe, and temporarily dewater a small portion of the creek. Riparian vegetation is replanted following construction, and erosion protection measures are installed as needed to prevent sediment from entering the creek.

Pipe repairs are performed as needed; however, despite its age, the pipe system is in good shape. Pipe replacements are also performed on an as-needed basis, and much of the system will need to be replaced over the next few decades. Pipe replacement work is performed during the summer low-flow periods, and work areas are contained to avoid/minimize impacts to the creek and its banks.

An in-line booster pump station is located on a pipeline approximately 2 miles downstream from Searsville Dam. The pump station boosts the water pressure, and also conveys water through a filter, in order to reduce sediments and silts before the water is delivered to customers downstream. The filters automatically operate a backwash cycle, which occurs frequently (i.e., daily, and sometimes hourly) during the pump station's operation, as the filters accumulate sediment. The backwash water is laden with the sediment from Searsville Reservoir, and is discharged to a perforated pipe within the bank above San Francisquito Creek. The presence, maintenance, and operation of the booster pump station and associated pipeline system from Searsville are not Covered Activities.

3.1.4.1 Potential Effects of the Maintenance and Installation of the Distribution System on the Covered Species

The presence of underground pipes, water lines that span the creeks on the underside of bridges, and above-ground filter, valves, and pump stations do not affect the Covered Species. However, the installation and maintenance of underground pipes and creek-spanning water lines could adversely affect the Covered Species.

The installation of new pipes and maintenance of existing pipes would be done during the dry season. Maintenance would be performed on an as-needed basis, and new pipes installed, on average, every 3 to 5 years. Ground disturbance associated with the maintenance of existing pipes and the installation of new pipes in the Lagunita area and foothills could harm or kill salamanders. If an occupied burrow were destroyed, it would likely harm or kill a California tiger salamander. Since maintenance and installation activities that require ground disturbance would be done during the dry season when California tiger salamanders are in their burrows, California tiger salamanders should not become trapped in temporary trenches.

Ground disturbing activities associated with the installation and maintenance of pipes in the Lagunita area, foothills, and near San Francisquito and Los Trancos creeks would temporarily disturb small amounts of garter snake habitat and could disturb individual snakes by frightening a snake away from the construction area.

Maintenance and installation of pipes near Matadero and Deer creeks could affect California red-legged frogs and garter snakes. Maintenance and installation of underground pipes would result in a temporary loss of habitat because vegetation removal and trenching would occur along the utility corridor, which is approximately 10 feet wide, and a trench would need to be dug. Such maintenance could occur once every 10 years. These activities could also result in frogs or snakes being disturbed and frightened. Minor changes in the creek bank or topography of the riparian areas would not have any long-term effects.

Maintenance and installation activities near Matadero and Deer creeks would not affect western pond turtles or steelhead because these species do not inhabit the creeks or adjacent riparian areas.

The maintenance and installation of pipes near San Francisquito Creek could affect California red-legged frogs, garter snakes, and western pond turtles. The maintenance and installation of underground pipes near San Francisquito Creek would result in a temporary loss of habitat for these species because vegetation removal and trenching would occur along the utility corridor, which is approximately 10 feet wide. Such maintenance could occur every 5 to 10 years. These trenching and vegetation removal activities could also frighten any individuals of these species that were in the vicinity of the work. California red-legged frogs, garter snakes, and western pond turtles are not present on Los Trancos Creek and would therefore not be affected by waterline maintenance and installation along that creek.

The maintenance and installation of water lines spanning San Francisquito and Los Trancos creeks (along the underside of bridges) generally would not affect the creek. Although these water lines are attached to the underside of bridges and are usually maintained from the bridge itself, it is possible that if major work in the future were required under the bridge, a coffer dam could be necessary, which would temporarily affect steelhead habitat and disturb individual steelhead. Use of a coffer dam for such work would likely occur one or two times in the life of the HCP. The installation and maintenance of pipes in the adjacent riparian areas would not adversely affect steelhead, and minor changes in the creek bank or topography of the riparian areas as a result of underground pipe maintenance and installation activities would not have any long-term effects.

3.1.5 Wells

Stanford maintains five groundwater wells. These wells primarily serve as a backup supply of potable water, but also are used to supplement the supply of irrigation water in the summer and fall. Well water is also occasionally used to maintain the water level in Lagunita. Operation and maintenance activities include mechanical and electrical work on the pumps, motors, valves, and control systems, as well as periodic refurbishment of the wells.

Due to the cost of operating the wells, Stanford minimizes the amount of time that they are in use. Stanford's wells are relatively deep (for the area), averaging 300 to 600 feet below the surface. Several thick clay layers, mostly laterally continuous and ranging from 20 to 80 feet thick, form aquitards above and between the coarse water-bearing units.

3.1.5.1 Potential Effects of the Wells on the Covered Species

All groundwater wells take water from at least 100 feet below the surface and they are not hydraulically connected to the creeks. They do not, therefore, affect the creek flow conditions and do not affect steelhead at all.

Maintenance activities at the surface portions of the wells could impact California tiger salamanders, garter snakes or western pond turtles. Such impacts would be confined to disturbing an individual of the Covered Species which might be hiding around the structure. The wells are located out of the current range of the California red-legged frog, and well maintenance will therefore not affect California red-legged frogs. Western pond turtles are only occasionally found in the area where the wells are located. California tiger salamanders and garter snakes are found in the general vicinity of the wells.

3.1.6 Non-operating Lagunita Diversion

The Lagunita diversion facility consists of a dam on San Francisquito Creek, a water-directing gate, and a flume that parallels the creek and extends to Lagunita. The existing facility was constructed in the late 1800s, but the CDFG installed a fish ladder on the structure in the mid-1950s, which has been modified several times since. The gate to the flume was closed in the 1980s following partial collapse of the flume, and the facility has not been used to divert water since 1985.

Maintenance activities on the dam and fish ladder consist of physical hand clearing of branches and debris from the ladder and occasional repairs of the ladder and the dam itself. Approximately 10 to 20 times per year during the rainy season, the ladder is cleared, usually after creek flows have subsided. Creek flow is usually not disturbed for this work; however, on average five times each year, the creek flow is deflected from the ladder, using a sheet of plywood, so that large debris can be removed from the ladder without water pressure behind it. This work is usually completed within an hour. On average once a decade, the creek flow is diverted using a coffer dam so that erosion under the dam can be repaired, the concrete repaired as necessary, and/or the ladder repaired.

3.1.6.1 Potential Effects of the Non-operating Lagunita Diversion

This diversion facility does not affect California tiger salamanders, garter snakes, western pond turtles or red-legged frogs because these species are not present at this site. California red-legged frogs have been reported in the vicinity of the structure, but none have been verified to be present in several decades. Western pond turtles have also historically been found in the area of the structure, but no western pond turtles have been observed at the structure for more than a decade.

Steelhead are found in the creek at the non-operating diversion structure, including the large pool downstream. Maintenance activities associated with the existing facility could have short-term adverse impacts on steelhead if a coffer dam were required to conduct maintenance of the structure or repair erosion downstream.

Dispersing steelhead routinely pass the structure. However, even with the fish ladder, the facility does not meet NOAA's current fish passage guidelines, and NOAA Fisheries believes that the presence of the in-stream facilities could impede steelhead recovery in the watershed. NOAA Fisheries has therefore asked Stanford to remove the barrier to improve juvenile and adult steelhead passage.

In 2006, Stanford studied potential steelhead passage improvements, and concluded that removing the existing fishway, concrete weir, and apron between the abutments and restoring the channel to a more natural configuration would best improve fish passage for adult and juvenile steelhead, and that this approach is preferred by fisheries agencies and environmental professionals. The estimated costs to design, permit, and perform the necessary construction to remove the facilities and restore the channel is $386,000 (in 2006 dollars). Stanford proposes to remove this facility to restore more natural adult and juvenile fish passage. Stanford will initiate the removal project within 3 years of NOAA Fisheries' approval of this HCP, and anticipates that it will take 2-4 years to prepare final plans; perform the necessary studies and environmental reviews; and secure the applicable federal, state, and local permits. The effects of removing the non-operating Lagunita Diversion are anticipated to be similar to the creek maintenance activities described in Section 3.2.1. If a coffer dam were used for removal of the non-operating diversion facility, the coffer dam and dewatering would temporarily affect steelhead habitat and disturb individual steelhead. The removal project is expected to provide long-term benefits to both upstream and downstream migrating steelhead by eliminating a long-standing fish passage impediment.

3.2 CREEK MAINTENANCE ACTIVITIES

Stanford conducts both routine and emergency creek maintenance work in and around all of the creeks on its property (including Deer, Matadero, Los Trancos, San Francisquito, Corte Madera, Bear, and Sausal). Routine maintenance consists of debris removal, including compliance with requests from the Santa Clara Valley Water District to remove downed trees and other debris from the creeks. This work is typically conducted during periods of low flow, but if an emergency arises, work in a creek can occur at any time of the year. Tree snags and other debris are removed only if they are disrupting the free flow of water or are causing undo erosion.

Debris removal and bank stabilization regularly occurs in the more urbanized areas of campus, such as areas near the Oak Creek Apartments and the Children's Health Council along San Francisquito Creek, near the Ladera Tennis Club along Los Trancos Creek, and near the Stanford Research Park along Matadero Creek.

Recent bank stabilization efforts at Stanford have involved sinking pillars into the existing bank, with little structural work done on the surface. In a number of locations, however, gabions, rip-rap, and concrete aprons are present. These older types of bank stabilization methods have a tendency to fail, and future repair work is therefore anticipated. During the life of the HCP, bank stabilization would only occur when needed. Stanford would conduct this bank stabilization using bioengineered structures and would not use gabions. Timing or need for bank stabilization is not known, but based on past experiences, Stanford anticipates constructing up to 10 bank stabilization structures during the life of the HCP, with each structure up to 200 feet in length, with no more than 50 percent of each structure consisting of hardscape materials such as rip-rap and concrete.

Stanford participates in an annual inter-agency maintenance effort that is coordinated by the San Francisquito Creek Joint Powers Authority (JPA) prior to the winter rainy season. The purpose of this effort is to remove obstructions that could cause flooding or bank erosion. An annual creek walk of San Francisquito Creek is organized by the JPA in September from the Oak Creek Apartments to El Camino Real during which the JPA, Santa Clara Valley Water District, Menlo Park, Palo Alto, and East Palo Alto survey conditions and agree on needed maintenance activities. Trash such as yard waste and other bulky items that are illegally dumped, large vegetation in the channel, fallen trees, and debris jams that extend into the center of the channel are identified during this annual creek maintenance walk. Any obstructions on sections of San Francisquito Creek that are maintained by Stanford are cut and collected using chainsaws and other hand tools, and removed from the creek channel by hand or by a truck-mounted crane where access is possible from the top of the bank. Fallen trees or other debris are usually removed during periods of low or no water flow. Fallen trees or debris jams that are too large to be removed by hand are occasionally encountered in the creeks. These require the use of large equipment and work crews. Due to accessibility, safety, and environmental concerns, heavy equipment remains at the top of the creek bank or on a side bench, if available, but are never used in an active channel. The heavy equipment is used to pull large pieces of debris out of the creek channel. In most reaches of Stanford's creeks fallen trees and other woody debris are left in place. However, fallen trees or other natural material are removed when there is a risk of flooding or at the request of a public safety agency.

In addition to Stanford's creek maintenance activities, public agencies with maintenance easements over Stanford's lands perform flood control and maintenance. Stanford does not have control over the public agencies' flood control activities, and these activities are therefore not included in the HCP.

San Francisquito Creek runs through the Stanford golf course, and creek-related activities associated with the golf course are described in Section 3.6.1, below.

Tributaries and drainage channels upstream from Searsville Reservoir on Stanford lands require annual maintenance in order to prevent flooding of adjacent roads and residential properties. These maintenance activities include periodic excavation of the existing channels, maintenance of constructed berms, vegetation removal, and bank stabilization.

During the life of the HCP, Stanford may restore the Corte Madera Creek channel and drainage areas upstream of Searsville Reservoir to prevent flooding of adjacent roads and properties. To address siltation that has caused Corte Madera Creek to become braided and result in upstream flooding, Stanford restored a 400-foot channel segment in 1997 through excavation of the primary old channel with heavy equipment, placement of boulders to stabilize the side of the channel, placement of excavated sediment as a berm alongside the channel, and placement of riparian plantings for bank stabilization. In the future, approximately once per decade, these maintenance activities may need to be redone and extended downstream to prevent upstream flooding. The work area is expected to be 2,000 feet long from the Stanford boundary to Searsville Reservoir and no more than 50 feet wide. The future activity would employ similar methods to those used in 1997 and described above. Placement of boulders would only be required in the first 400 feet of the creek, in the same location as the 1997 restoration. Any amount of permanent land conversion associated with this project would be mitigated in accordance with Section 4.4 of the HCP.

3.2.1 Potential Effects of the Creek Maintenance Activities on the Covered Species

Creek maintenance activities will not affect California tiger salamanders because the creeks at Stanford do not support this species. The hand removal of debris and fallen trees in areas deemed at risk of flooding can cause short-term impacts, but few long-term effects on western pond turtles, California red-legged frogs, garter snakes, and steelhead because very few of these species inhabit downstream reaches that would be affected by the removal. For example, the loss of large woody debris from the creeks may reduce channel complexity and the diversity of microhabitats that provide a positive benefit for steelhead. In the rare case where the use of heavy equipment is required, this could have a short-term effect on western pond turtles, California red-legged frogs, garter snakes, and steelhead. Again, as these activities are concentrated in the downstream, more urban portions of Stanford's creeks, impacts to the Covered Species will be limited to altering steelhead habitat and temporarily disturbing any steelhead in the vicinity of the work.

Bank stabilization efforts, even with comparatively little surface work, often require diverting a portion of the creek – via coffer dams and a bypass pipe. Such work has the potential to adversely affect steelhead through dewatering, fish relocation, and modification of the streambank. Bank stabilization work would frighten any individual western pond turtles, California red-legged frogs, or garter snakes that would be in the vicinity of the work. Tiger salamanders would not be affected by bank stabilization efforts because these areas are not occupied by California tiger salamanders. Further modification of the Corte Madera Creek channel would result in the loss of potential California red-legged frog, garter snake, and western pond turtle habitat.

3.3 FIELD ACADEMIC ACTIVITIES

3.3.1 Jasper Ridge Biological Preserve

Scientists have conducted research at the Jasper Ridge Biological Preserve continuously since 1891, long before it was formally designated a biological field station. This extensive research includes long term studies that are landmarks in ecology and population biology. Jasper Ridge Biological Preserve has a long policy of biological non-intervention, and the vast majority of work conducted at the Preserve does not involve the broad manipulation of natural resources.

Because many of its ecosystems are so well documented and understood, the Preserve provides unique opportunities for scholars to seek answers to questions involving long-term monitoring and observations that could not be performed elsewhere. In addition, the careful management of the Preserve's ecosystems, with a prohibition on large-scale manipulative studies, allows scientists to quantify changes observed in similar ecosystems that are subject to a range of human activities. In addition to facilitating first rate research, this highly accessible field station provides rich undergraduate and graduate educational experiences and plays an active role in educating the general public.

Jasper Ridge maintains a series of trails that facilitate research and teaching. These trails are packed dirt and generally no more than 5 feet wide. Monitoring facilities, such as weather stations, motion-detecting camera stations, and automated sound recording devices, are used throughout the Preserve, and require routine servicing, such as cleaning, vegetation trimming, etc.

The collection of biotic specimens and the sampling of water, soils, and rocks is frequently part of the teaching and research that occurs at Jasper Ridge. This collection is strictly controlled by Stanford.

Access to biologically sensitive parts of Jasper Ridge, particularly areas where individuals of the Covered Species may reside, is carefully controlled.

3.3.2 Creeks

Researchers at Stanford conduct field activities in the creeks on an annual basis. Much of the research involves monitoring California red-legged frogs, steelhead, and other native fishes that live in the creeks. These efforts also monitor the changes in abundance of non-native species such as bullfrog, mitten crab, and crayfish. Geology and engineering researchers also utilize the creeks on a regular basis to perform research and to support teaching. Like research at Jasper Ridge, research in the creeks is primarily observational and typically non-manipulative. Some collection of specimens, both physical and biotic, does occur.[4] Access to creeks is strictly controlled by Stanford, and is limited to trained researchers; introductory classes and large numbers of students are prohibited from the vast majority of creeks. Monitoring devices are occasionally placed in the creeks or in the riparian zone.

3.3.3 Foothills and Alluvial Plain

Faculty and students from many academic departments routinely use undeveloped portions of the Stanford foothills and alluvial plain.[5] The activities conducted by these academic groups range from field studies in geology, archaeology, and engineering, to more humanities-oriented exercises in photography and cinematography. The field studies generally do not involve manipulations of biotic variables or significant earth moving. Study test pits and trenches are, however, used annually in the geology, geophysics, and earth systems courses. These range from simple soil borings to hand excavation of a trench up to 10 feet by 2 feet that remain open for up to a week. There are a number of academic facilities situated in the relatively undeveloped portions of the Stanford foothills and alluvial plain, including student observatory, solar observatory, radio telescopes, independent research institutions, and several plant growth facilities. These facilities require ongoing maintenance and are frequently upgraded (and occasionally expanded). Rodent and vegetation control is conducted at the facilities. Buildings in the main campus are discussed in Section 3.5.5.

Some collection of specimens, both physical and biotic does occur. Access to the foothills for academic purposes is controlled by Stanford, and is limited to approved researchers and classes. The biotically sensitive portions of this area are held off-limits to general studies. Monitoring devices are occasionally placed in the foothills.

There are more than 60 prehistoric archaeological sites and a number of historic period archaeological sites on Stanford's lands. Prehistoric sites include prehistoric Ohlone-Costanoan villages, cemeteries, stone tool raw material quarries, bedrock milling stations and petrogylphs. Historic archaeological discoveries at Stanford include Mexican rancho sites, gold rush towns, American ranches, Japanese and Chinese labor camps, 1906 earthquake rubble dumps, and trash pits associated with early campus housing. Stanford employs a university archaeologist to oversee the protection of the cultural resources, and to facilitate research and teaching activities at these sites. Research focusing on these resources occasionally involves extensive digs and vegetation clearing. These digs are not located within the creeks, but several of the digs have been in locations adjacent to the creeks. Archaeological teaching and research activities are dictated by the size and composition of the archaeological resource. A large-scale archaeological dig might last up to 15 months and consist of a main pit 450 square feet by 6 feet deep, with smaller associated pits. It is roughly estimated that

Stanford could undertake up to five large-scale digs near the creeks during the life of the HCP. In addition, it is estimated that Stanford will conduct smaller investigations (e.g., a set of 10 pits, each 18 square feet, 3 feet deep) every few years. Pits are refilled at the end of the archaeological dig.

Additionally, researchers from the University engage in restoration biology throughout the lower foothills. In 2000, the University began funding this restoration work, and the goal is to find cost-effective ways to improve the existing non-native-species-dominated communities. This goal serves the University's desire to conserve its natural resources and the desire to improve the academic value of the lower foothills.

3.3.4 Lagunita

Lagunita is occasionally used by classes and researchers as an outdoor laboratory and study site. Generally, these academic activities are non-invasive and involve walking around Lagunita, making observations, taking water samples, and sometimes using small boats or rafts to collect information.

3.3.5 Potential Effects of the Field Academic Activities on the Covered Species

Academic activities could have direct and indirect effects on the Covered Species, but most of the impacts of Stanford's academic activities would be exceedingly minor and of short duration. Most of the academic activities that could cause take involve students or researchers walking through an area where the Covered Species were found. It is unlikely that an individual of a Covered Species would be stepped on or otherwise directly encountered during such activities. Individuals of the Covered Species found in the immediate vicinity of these academic activities could be disturbed by academic activities and alter their behavior. Additionally, if the number of person-visits to an area occupied by a Covered Species were too high, there could be some habitat degradation, or the behavior of Covered Species could be altered.

More invasive academic pursuits, including such tasks as archaeological digs, digging of geological test pits, and conducting

[4] This collection does not include Covered Species unless permits are obtained from the appropriate agencies.
[5] The main academic campus is located on an alluvial plain.

habitat restoration projects, also could have short-term adverse effects on the Covered Species, including short-term habitat degradation. Individuals could become trapped in open pits. Continuous visits (i.e., an on-going archaeological dig) could disturb individuals and/or cause Covered Species to leave the area. It should be noted that many of the research activities (e.g., water quality testing, soil characterizations, population studies) would result in information that provides substantial positive benefits to the Covered Species.

The maintenance of facilities, mainly dirt trails and monitoring stations, associated with field academic activities would have only a minor potential to impact Covered Species. As this work typically would occur during daylight hours and during the dry season, any potential impacts would be short-term and minor.

3.4 UTILITY INSTALLATION AND MAINTENANCE

A large number of above- and below-ground power, communication, steam, chilled water, water, sewer, and drainage (e.g., flow-filtering manholes and detention basins) utilities, and related facilities exist at Stanford.[6] There also is an extensive steam and chilled water system on the main campus. Storm drains are located throughout campus and drain into either San Francisquito Creek or Matadero Creek. A majority of these facilities are located in the main campus. However, essentially all parts of the campus are served, and hence crossed, by utility lines. In addition, existing utilities will have to be improved, and new utilities will be installed during the life of the HCP. Stanford may need to construct additional utility facilities and lines to fully utilize existing utility facilities. Other improvements also might be needed to accommodate new technologies. For ease of operation, and to reduce the potential environmental effects, most new utilities are installed in existing utility corridors.

Many of the existing utilities, including major domestic water supply facilities and power supply utilities, are located in areas that are occupied by the Covered Species. Domestic water system utilities also are located adjacent to, through, and under creeks. Maintenance of existing and new utilities, including utilities located in habitat areas, includes vegetation control around the utility lines and replacement of utilities and associated infrastructure such as power poles. Utilities located in undeveloped areas are generally accessed by designated access roads or by driving through open grasslands. Underground work is typically limited to a defined utility corridor. When work is done away from existing roads, the surface is usually replanted with a mix of native grasses and forbs (for maintenance considerations, shrubs and trees are not typically planted on top of or below utility lines).

[6] Some of the utilities such as PG&E and SFPUC facilities are not owned by Stanford. These facilities and the maintenance, repair, and other activities associated with these facilities may be covered under this HCP through Certificates of Inclusion, which are described in Chapter 6.

3.4.1 Potential Effects of Utilities on the Covered Species

Maintenance and improvements to existing infrastructure are typically confined to the existing footprint of the structure, and, as such, these activities usually have a minimal and temporary effect on the Covered Species. However, some of the maintenance actions, including ground disturbing activities, new utility installations, and utility line maintenance or replacement, and work in, under, or adjacent to creeks (e.g., pipeline repair, temporary use of coffer dams, etc.) can result in the take of Covered Species.

Ground disturbance associated with the maintenance or replacement of existing utilities could adversely affect tiger salamanders, red-legged frogs, and garter snakes. These species could become trapped in open trenches or holes if construction sites were not properly fenced or covered. Pond turtles and steelhead are much less likely to be impacted by ground disturbance activities.

The installation of new infrastructure also could adversely affect the Covered Species, and the magnitude and duration of the effects depend upon the type of infrastructure that was installed and the location of the new infrastructure. Installation activities near or across the creeks would have greater effects on the Covered Species located in the creeks, and could result in take; whereas, the installation of new utilities in the developed portions of the campus would likely not affect the Covered Species. The installation of new utilities in the foothills also could impact California tiger salamanders and garter snakes, but would not have an effect on the other Covered Species. The amount of any permanent land conversion associated with new infrastructure would be mitigated in accordance with Section 4.4 of the HCP.

3.5 GENERAL INFRASTRUCTURE

Urban infrastructure exists in areas that are occupied by or provide habitat for the Covered Species. This infrastructure includes private roads, unpaved service roads, private bridges, fences, detention basins, buildings, and private residences. Operation of the University, and much of the surrounding community, depends upon the operation of this infrastructure. Therefore, it is mandatory that these uses be maintained. Also, the addition of new structures at existing facilities or operational changes may be necessary.

3.5.1 Roads and Bridges

There is a broad network of Stanford-controlled roads that provide access to all of Stanford. These private roads range from paved four-lane roads in the main campus, to narrow dirt or gravel service roads in the undeveloped portions of the University.[7] These roads are maintained regularly, both for public safety and in an effort to reduce environmental impacts.

[7] Golf cart paths are not part of the Stanford roadway network, and are therefore included in the Golf Course Covered Activities.

The type and frequency of road maintenance depends upon the route; heavily traveled paved roads generally require more frequent maintenance than rural service roads. As part of Stanford's road maintenance activities, roads are occasionally rerouted. Resurfacing, vegetation control, and other similar maintenance activities are conducted during daylight hours, and during periods of no rain. Roads are occasionally realigned, most often in response to public safety concerns or in an effort to reduce environmental impacts.

New roads are occasionally required for public safety or as land uses change. New roads that were not associated with replacement and restoration of an existing road in a more sensitive location would result in a net loss of habitat. The amount of permanent land conversion associated with a new road would be mitigated in accordance with Section 4.4 of the HCP. In addition to Stanford's system of private roads, several public roads cross Stanford (e.g., Junipero Serra Boulevard, Sand Hill Road, and Stanford Avenue). Activities by Stanford on the public roads located on Stanford's lands are Covered Activities. Stanford sometimes encroaches into these roadways to maintain utilities or construct salamander tunnels, and these activities are covered by the HCP.

Several private bridges are included in the Stanford roadway system. These bridges are used by authorized University personnel, although several also are used by the public at the golf course and along Piers Lane. These are maintained and improved on an as-needed basis. Maintenance is generally restricted to resurfacing the structure or to trimming overhanging vegetation, but occasionally more significant structural work is required, including replacing spans or supports or the entire bridge. In some situations, a small portion of the creek, typically less than 200 feet, is temporarily contained in a pipe as the creek channel up and downstream of the bridge is spanned with coffer dams. Major bridge work is fairly infrequent, and it is expected that during the 50-year span of the HCP, coffer dams and bypass pipes will only be needed on three or four occasions. In addition, it is possible during the life of the HCP that Stanford would need to construct new bridges. It is anticipated that any new bridges would span the creeks, with no permanent structures within the creek channel, and that no more than six bridges over creeks where Covered Species are located would be constructed. Construction of new bridges could require temporary falsework in the creek, vegetation removal, and dewatering with coffer dams and bypass pipes.

3.5.1.1 Potential Effects of Roads and Bridges on the Covered Species

Roadway maintenance could disturb habitat for all Covered Species. Indirect take caused by reduced vegetation or minor maintenance-related runoff would also be very limited, and would consist of few individuals of the Covered Species relocating themselves away from inhospitable areas. Likewise, maintenance workers and equipment could temporarily disturb habitat.

Repair or maintenance of existing bridges or bridge construction could also adversely affect steelhead and California red-legged frogs in the creek. These activities could require the use of falsework and coffer dams, resulting in adverse affects to juvenile steelhead and red-legged frog tadpoles and metamorphs. If an area were de-watered, the relocation of these animals could result in mortalities and increased competition for resources at the relocation site. Maintenance workers and equipment on the creek bank may also disturb red-legged frogs, garter snakes, and western pond turtles.

No disturbance of California tiger salamanders is anticipated during bridge maintenance because tiger salamanders are not found near the creeks at Stanford. Many California tiger salamanders are killed by traffic on roads at Stanford. However, most of the mortalities occur on Junipero Serra Boulevard, a Santa Clara County road that traverses the campus near Lagunita.

3.5.2 Fences

Fences are widespread in the undeveloped portions of campus. Many of the fences are used to control public access, while others define leaseholds. The agricultural tenants also operate a series of fences. In addition, fences are a necessary component of conservation planning at Stanford and are used to protect valuable habitat.

Fences at Stanford are inspected and repaired on a continuous basis. Vandalism, fallen trees, auto accidents, and simple aging all take their toll on the fences. Fence repair work is usually quite simple. A work crew drives as close as possible to the damaged fence and repairs the fence by hand, though power augers are occasionally used for post-hole digging. In addition, Stanford commonly moves existing fences, removes unused fences, and installs new fences. In the case of new fences, shrubby vegetation is sometimes cleared from the fence route.

3.5.2.1 Potential Effects of Fences on the Covered Species

The installation and maintenance of fences at Stanford is a fairly low impact endeavor. It is possible that individual California tiger salamanders, California red-legged frogs, and garter snakes could be disturbed by replacing a fence post or by workcrews accessing the site. The fences do not act as barriers to migration of Covered Species.

3.5.3 Detention Basins

Stanford recently constructed stormwater detention basins within the central campus to intercept increased runoff that may be caused by future campus development. The basins are earthen (unlined), and include subdrains and pipe systems to convey accumulated runoff to the regional storm drain system. The currently existing detention basins in the San Francisquito Creek watershed are just over 1 acre in size and located along Sand Hill Road near Stock Farm Road. Additional detention facilities (basins and/or buried pipe systems) are planned along Sand Hill Road, both north and south of the existing basins, for future development in the west region of campus. The detention basins located in the Matadero Creek watershed are approximately 3 acres in size and are located along El Camino Real near Serra Street. This detention system is designed to accommodate 100-year storm events (i.e., storms of a sufficient magnitude that they have no more than a 1 percent chance of occurring in any given year). The new detention basins will detain the increased runoff and keep it from entering San Francisquito Creek or Matadero Creek until well after the peak creek flow has receded. In the event of a 100-year storm, the basins are designed to drain within approximately 2 days (48 hours). During storm events of lesser magnitude, the basins would hold water for a shorter period of time. The purpose of the basins is to reduce peak flows by detaining a portion of the runoff for a short period of time. The basins do not provide long-term water storage.

3.5.3.1 Potential Effects of the Detention Basins on the Covered Species

While detention basins are temporarily collecting storm water, individual California tiger salamanders may be attracted to them and interrupt their migration to suitable breeding locations. However, while the basins located near Sand Hill Road are within migration distance of the California tiger salamanders, there are significant barriers located between Lagunita and the basins and CTS surveys have not found them in the basins. While California tiger salamanders are not expected to be present, there is a remote possibility that an individual could be found at the detention basin as the population expands. There are no garter snakes, red-legged frogs, or western pond turtles at the detention basins.

3.5.4 Isolated Private Residences

There are a number of modest private residences near Los Trancos Creek and San Francisquito Creek. These residences are not part of defined residential neighborhoods, and are generally associated with the agricultural and equestrian uses (one exception is a residence that houses University personnel involved in the operation of rural University facilities and lands). These houses and their associated yards are subject to normal residential activities including building maintenance, repair and modification, vehicle storage, etc.

3.5.4.1 Potential Effects of Isolated Private Residences on the Covered Species

The limited number of these isolated residences and their location away from the most biologically sensitive areas makes it unlikely that they have an effect on the Covered Species. However, maintenance and ongoing use of residences could result in limited take of California red-legged frogs, western pond turtles, and California tiger salamanders. Such take would likely be in the form of an individual of a Covered Species straying from appropriate habitat into an area of human activity, and subsequently being harmed or trapped. Garter snakes have not been recorded from near the isolated private residences, but it is plausible that a garter snake could enter into a developed area.

3.5.5 Academic Buildings

Stanford's central campus includes approximately 13 million square feet of academic, academic support and housing structures, including student residences, libraries, laboratories, and lecture halls. The central campus also includes faculty/staff housing. These buildings and their associated landscaping are continuously maintained, frequently modified, and occasionally demolished. New buildings are constantly being constructed, and are discussed under "Future Development." Academic buildings located out of the main campus were discussed under "Academic Activities."

3.5.5.1 Potential Effects of Academic Building Maintenance on the Covered Species

Covered Species that enter into the built portions of campus will likely die, due to the number of hazards in the urban environment. Maintenance and modification of these buildings could potentially harm a Covered Species, particularly California tiger salamanders that are occasionally found near buildings adjacent to Lagunita. Additionally, garter snakes are occasionally observed in and around the buildings adjacent to

Lagunita. These snakes leave the area as soon as they are encountered by people.

3.6 RECREATION AND ATHLETICS

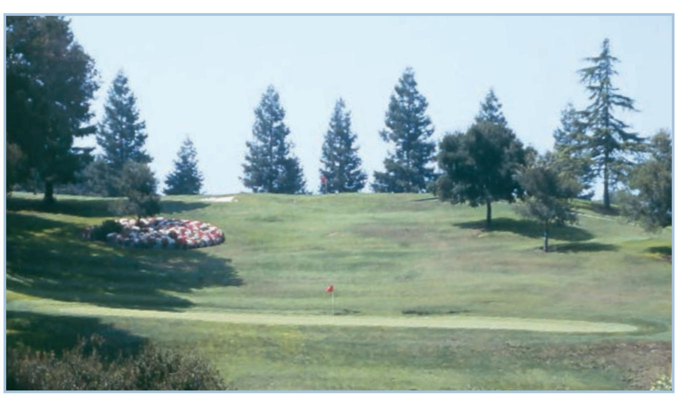
3.6.1 Stanford Golf Course, Practice Facility, and Driving Range

Stanford University operates an 18-hole golf course north and south of Junipero Serra Boulevard, to the southeast of Sand Hill and Alpine roads (Figure 3-2). There are no pooled water hazards associated with the course; however, San Francisquito Creek flows through the course. There are several cart bridges over the creek and a network of golf cart paths that allow players to access the course.

Golf course maintenance practices are focused on mowing and fertilizing the greens, fairways, and roughs; maintaining the paved golf cart paths; and, in areas that golf play crosses San Francisquito Creek, trimming riparian vegetation on a regular basis. Stanford utilizes an integrated pest management approach for golf course maintenance. Pesticides for weed and insect control are only used as a last resort and in accordance with all State and local pest control regulations. The Stanford golf course has been designated as a "Clean Bay Business" certified by the City of Palo Alto for hazardous materials handling and storage efforts. The pesticide use decreased approximately 75 percent since the mid-1990s. Pests are now spot-treated, as opposed to the previous method of broadcasting those treatments. The "roughs" have been naturalized to provide understory vegetation for wildlife. Pesticide use will continue to be used in this way, but pesticide use is not a Covered Activity

There is also an approximately 25-acre golf practice facility located adjacent to the main golf course and Sand Hill Road. This facility is operated and managed in a manner similar to the main golf course.

In addition to the 18-hole course, there is a driving range on approximately 13 acres of modified grassland next to Lagunita on its northwest side. The driving range has its own parking lot, service building, strip of tee boxes, putting green, and chipping mound at the northwest end. The range also includes lighting to allow nighttime operation, target greens, and distance markers. Operating hours are from 8:30 a.m. to 10:00 p.m. on weekdays and from 7:00 a.m. to 10:00 p.m. on weekends. The range closes early on rainy nights.



Driving range balls are collected from noon to closing, depending upon the need. Ball collection is done mechanically using a tractor-driven collecting device. A fence is located at the south end of the range to keep balls on the irrigated part of the turf, which makes ball collection easier.

The golf course, practice facility, and driving range are periodically redesigned. These changes typically involve moving tees or green locations. These moves are located within the existing footprint of the highly modified landscape.

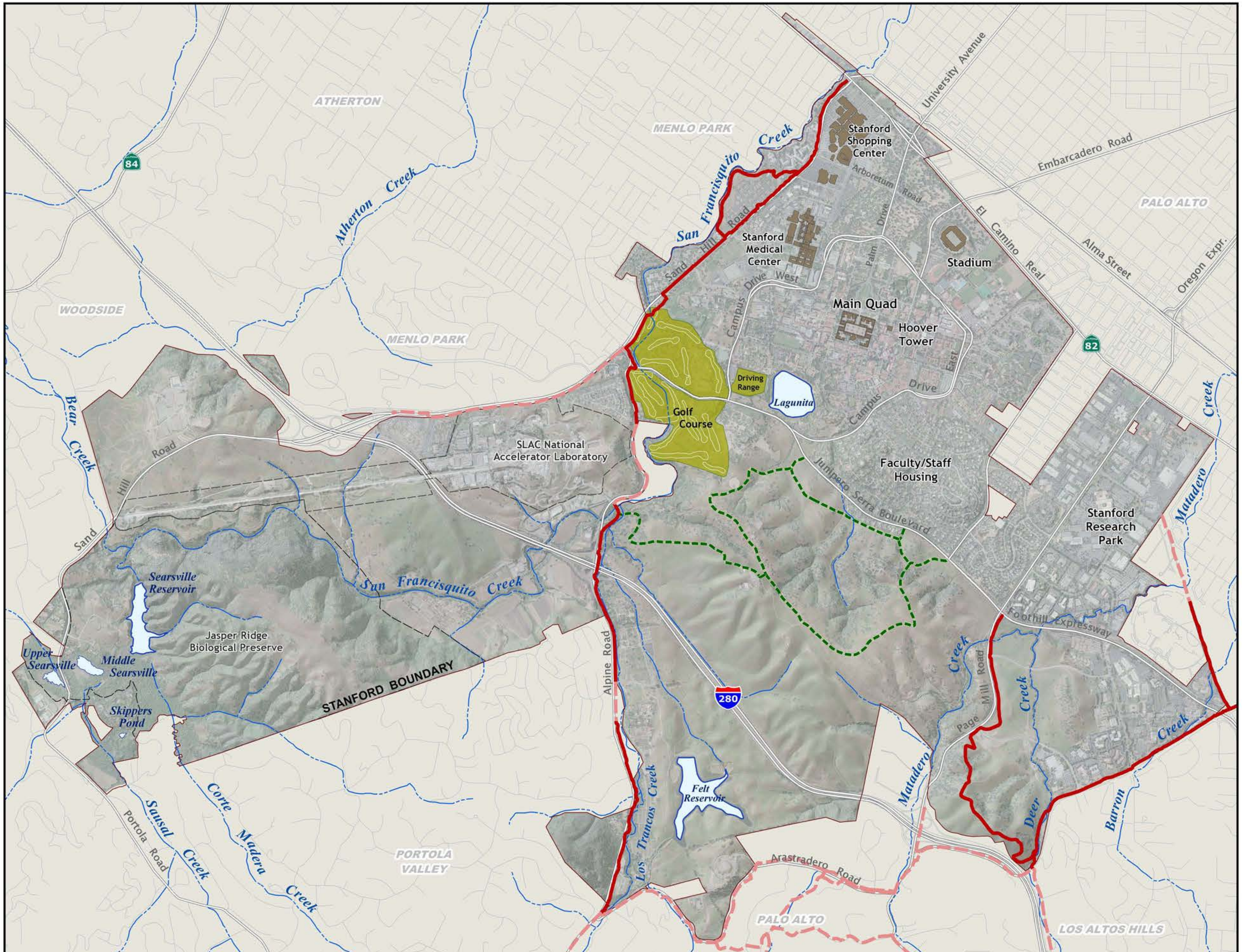
3.6.1.1 Potential Effects of the Golf Course, Practice Facility, and Driving Range on the Covered Species

Operation and management of the golf course, practice facility, and driving range may adversely affect California tiger salamanders and garter snakes. California tiger salamanders and garter snakes do not utilize the fairway and green portions of the golf course, practice facility, or the driving range for upland habitat, because it is manicured lawn and burrows are not present. California tiger salamanders and garter snakes will traverse the open areas, the fairways, and the greens, but they seem to avoid them as exceedingly few California tiger salamanders and no garter snakes have been observed in such areas during the last 15 years of monitoring at Stanford. Undeveloped portions of the golf course and driving range that are not surrounded by manicured fairways are occupied by California tiger salamanders and garter snakes. California tiger salamanders and garter snakes could also be impacted through mowing of turf, fairways, and greens, and the maintenance of vegetation in the areas adjacent to fairways and greens.

Ball retrieval at the driving range during rainy nights has the potential to harm or kill California tiger salamanders and garter snakes. However, the driving range typically closes on rainy nights due to lack of use and the balls are generally not retrieved during the rain.

The operation and maintenance of the Stanford golf course, practice facility, and driving range may affect western pond turtles and steelhead, through mowing turf, fairways, and greens; maintaining vegetation in the areas immediately adjacent to fairways and greens; maintaining cart bridges; and trimming riparian vegetation where the course plays across the creek. This trimming could disturb steelhead and western pond turtles, and result in the loss of habitat. The reduction in riparian vegetation at the golf course likely does not cause a significant or long-lived increase in water temperature in San Francisquito

Stanford University Habitat Conservation Plan



Recreational Uses

- "Dish" Recreational Route
- Public Trail on Stanford Land
- Public Trail
- Golf Course

hectare

100
25
4

acres

Sources:
Public Trails:
Santa Clara Co. Trails Master Plan Update, Nov. 14, 1995
San Mateo Co. Trails Plan, Draft Program EIR, Oct. 1999
Creeks: US Geological Survey, 1991

Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 3-2

Creek. California red-legged frogs have not been observed at the golf course or areas downstream for several decades.

Maintenance of the cart bridges could affect the western pond turtles, garter snakes, and steelhead, particularly if major work were required. While even major work is typically conducted outside of the creek banks (using cranes), it is possible that under some circumstances the creek would need to be diverted around the repair site using coffer dams and by-pass pipes. Such extensive work would affect steelhead and possibly western pond turtles and garter snakes.

3.6.2 Lagunita and Felt Reservoir-Related Recreation

Since 2001, Stanford has not used Lagunita for scheduled recreational purposes. In the past, however, numerous community and University activities occurred at Lagunita. During non-drought years, the Stanford Windsurfing Club used Lagunita for windsurfing courses. To support this activity, the Windsurfing Club would bring in storage containers that contained sail boards and small boats. Students could use the sailboards and boats on their own or take lessons throughout the spring quarter during the hours of 9 a.m. to 6 p.m. To facilitate recreational activities, emergent aquatic vegetation was mechanically cleared from part of Lagunita during the late spring and several tons of sand was imported to create a swimming beach. During those periods of formal recreational use, Lagunita was monitored by Stanford for several health-related parameters (Coliform bacteria levels, etc.). Despite the regular outbreaks of "swimmer's itch", a generally harmless condition caused by a trematode parasite, Lagunita was a very popular recreational facility.

Formerly, Lagunita was the site of the annual Big Game Bonfire and a mud volleyball fund-raising event. These two popular, traditional events probably had an adverse effect on the California tiger salamanders at Lagunita and were therefore cancelled in the early 1990s.

A partially developed trail system encircles Lagunita. This trail is open and receives heavy public use, including many dogs.

Felt Reservoir is used on a regular basis for equestrian uses and sailing courses. Felt Reservoir is located in an area that is subject to an equestrian lease; however, the reservoir is not open to the public.

3.6.2.1 Potential Effects of Reservoir-Related Recreation on the Covered Species

Currently, of the Covered Species, only western pond turtles are occasionally found at Felt Reservoir. However, California red-legged frogs and garter snakes could be found at the reservoir in the future. Sailing courses could result in short-term avoidance behavior by these species. Equestrian uses also could result in short-term avoidance behavior but horses could kill or injure adult and juvenile individuals of these Covered Species if they did not move off an equestrian trail adjacent to the reservoir.

The past use of Lagunita for recreational purposes may have adversely affected California tiger salamanders and garter snakes. However, historically the recreational uses prompted the University to fill Lagunita, and likely facilitated California tiger salamander and garter snake breeding at Lagunita and persistence at Stanford. People using the trail around Lagunita may disturb California tiger salamanders and garter snakes. However, it is unlikely that the trail is used on rainy nights when California tiger salamanders are generally migrating.

3.6.3 Recreational Routes

The Santa Clara County Countywide Trails Master Plan identifies several trails through Stanford, and several public trails currently exist (Figure 3-2). The Los Trancos Creek and Adobe Creek trails have been in place for several years, and a portion of the San Francisquito Creek trail was included in the streamside open space plan approved by the City of Palo Alto. Stanford's 2000 General Use Permit requires implementation of the Santa Clara Countywide Trails Master Plan though the construction, operation, and dedication of two trails that are located roughly along San Francisquito/Los Trancos creeks and Matadero Creek.

Stanford also maintains recreational routes in the "Dish" area of the foothills between Junipero Serra Boulevard and I-280. Recreational use to the area began in the mid-1980s, and Stanford posted a clear set of rules and regulations governing the uses of the trail. Prior to 2000, Stanford did not have the resources to enforce the rules and regulation. As a result more than 13 miles of unauthorized footpaths and an array of structures were built (e.g., tree houses, labyrinths, fire rings, and tunnels). There was 24-hour-a-day access, and numerous dogs were not contained on leashes. In 2000, Stanford initiated a foothills management program, and now pedestrian traffic is only allowed on designated trails. Non-designated trails have been closed off and are being restored, dogs are no longer permitted, and there are frequent security patrols. These measures will reduce human impacts on the flora and fauna of the foothills. The recreational routes are part of the University's paved service roads. Maintenance of these roads and potential impacts on Covered Species are discussed in Section 3.5.1.

3.6.3.1 Potential Effects of Recreational Routes on the Covered Species

Recreational use of the foothills by pedestrians is now regulated by the University, and members of the public rarely stray from designated paths and are not allowed on-site after dark. Dogs are not allowed in the Dish area of the foothills. Use and maintenance of these recreational routes could disturb California tiger salamanders and garter snakes.

Recreational use of future trails associated with the 2000 General Use Permit along San Francisquito, Los Trancos, and Matadero creeks could affect California red-legged frogs, steelhead, garter snakes, and western pond turtles by bringing humans in proximity to the creeks, but use of the trails will be subject to rules and regulations prohibiting entry into the creeks and unauthorized disturbance of riparian vegetation. In addition, the improvement, operation, and ongoing maintenance of the existing trails could affect these Covered Species through bank stabilization activities.

3.7 GROUNDS AND VEGETATION

3.7.1 Fire Control and Public Safety

Stanford engages in several fire control and public safety activities, including the maintenance of fire breaks and vegetation control. Various techniques are used to control weeds so that they do not become fire hazards in the summer and fall months. The primary techniques are flail mowing, discing, and herbicides. Flail mowing is used for weed suppression in open fields with tall grasses. The mower is attached to a tractor and can cut grass down to ground level. Flail mowing of approximately 70 acres is typically done one to three times during the summer in open space areas. Discing and mowing are used to create fire breaks in grassland areas. Discing is typically used along roads and pathways in the foothills and along Junipero Serra Boulevard. The amount of discing that is typically conducted in sensitive California tiger salamanders areas south of Junipero Serra Boulevard is estimated to be 4,500 feet by 20 feet wide, or a total of about 2 acres.

3.7.1.1 Potential Effects of Fire Control Activities on the Covered Species

All of the vegetation control methods used for fire control can result in adverse effects to California tiger salamanders, garter snakes, or California red-legged frogs. Mowing is currently used to manage vegetation and improve areas for California tiger salamanders. Discing during the dry season is unlikely to adversely affect Covered Species, because the depth of the discing is fairly shallow (approximately 6 inches) and the rodent burrows supporting California tiger salamanders (and possibly California red-legged frogs) tend to be much deeper. Discing could harm any garter snakes present on the surface.

Herbicides could affect the Covered Species by either directly entering occupied burrows or through runoff into the creeks. However, herbicides are generally used as a last resort and on a spot-treatment basis, reducing the likelihood of contaminated runoff or ground saturation. Herbicide use is not a Covered Activity.

3.7.2 Grounds Maintenance

The Stanford Grounds Department maintains the landscaping throughout the campus, including planting and pest control (i.e., weeds and animal pests). The following is the list of activities that Stanford carries out that could affect the Covered Species.

General Maintenance. The Stanford Grounds Department manages formal landscaped areas, including lawns, planters, and road medians. These areas are re-planted, trimmed, irrigated, fertilized, and mowed as needed. Maintenance activities also require substantial infrastructure, including irrigation boxes (e.g., housing valves, timers, etc.). Herbicides are typically used only in the formal landscaped areas and along roads for weed control.

Animal Pest Control. In some locations on campus, burrowing mammals, including ground squirrels, gophers, and moles, need to be controlled for safety reasons and because they destroy the landscaping. Underground poison bait stations and traps are used to control ground squirrels. The bait stations are placed near parking areas and in open fields. Moles and gophers are controlled using traps and poison bait placed in their tunnels. Rats and mice also are controlled via various methods throughout the developed part of campus. Pesticide use is not a Covered Activity, although the other animal pest control methods are Covered Activities.

Temporary Stockpiling/Staging. Stanford periodically has a need for temporary stockpiling of dirt, compost materials, or construction materials on its lands.

Weed Control. Various techniques are used to control weed growth throughout the campus, including mulch cover (wood chips), flail mowing, discing, and herbicides. Wood chips from oak, eucalyptus, and other hardwood trees, are placed along pathways and roads, and around trees and buildings to suppress weed growth, retain water, and suppress fire, and flail mowing is used for weed suppression in open fields with tall grasses. The discing of broad areas was commonly used to control weeds until the early 1990s, but was discontinued in most of the environmentally sensitive areas in favor of the more environmentally sound mowing.

3.7.2.1 Potential Effects of Grounds Maintenance Activities on the Covered Species

Grounds maintenance and vegetation control activities at Stanford have been modified as a result of the implementation of the California Tiger Salamander Management Agreement in June 1998 to avoid and/or minimize the potential effects of the above described activities on California tiger salamanders. Under most circumstances, activities conducted by the Grounds Department would not result in direct take of the Covered Species.

General Maintenance. Since these activities occur primarily in the built portion of campus or in association with a facility, they would not have direct effects on California red-legged frogs, western pond turtles, or steelhead. However, stray California tiger salamanders and garter snakes are found scattered throughout campus and garter snakes and California tiger salamanders could get trapped in irrigation boxes, and landscaping activities could harm individuals.

Animal Pest Control. Control of burrowing mammals can indirectly affect California tiger salamanders by reducing the number of burrows available. It also is possible that the indiscriminate use of rodenticides can cause toxins to enter the local food chain, and affect the Covered Species (primarily California tiger salamanders), and it is also possible that California tiger salamanders can be directly harmed by traps. These pest control efforts do not impact garter snakes, western pond turtles, or steelhead.

Temporary Stockpiling/Staging. The placement of stockpiled materials could affect the terrestrial Covered Species. Individuals of these Covered Species could take refuge in stockpiled materials, resulting in possible take when the materials were moved.

Weed Control. The use of wood chips is unlikely to affect the Covered Species. Mowing also is not likely to directly affect the Covered Species because the timing and location of mowing (open grasslands, daytime, and in dry weather) does not coincide with periods when any of the Covered Species would be present. Biocides would be used according to industry standards and applied by well-trained crews, and their use is not a Covered Activity.

3.8 AGRICULTURAL AND EQUESTRIAN LEASEHOLDS

3.8.1 Intensive Agriculture

Intensive agriculture has been conducted at Stanford for more than a century. Currently, seasonal crops, a vineyard, and a plant production/wholesale nursery are located on Stanford property (Figure 3-3). Stanford has historically played a limited role in the day-to-day operation of its agricultural lessees. Each lessee is responsible for the construction and maintenance of all roads, buildings, and other improvements on the leasehold.

Ranch/Farm. A farm with 260 acres of crops is located in San Mateo County, on the alluvial plain adjacent to San Francisquito Creek. The farm produces a wide variety of organic and non-organic seasonal crops, some of which are sold at an on-site, road-side market. The working ranch/farm requires a number of facilities (storage sheds, maintenance yards, worker housing, etc.), which are scattered throughout the leasehold.

Nursery. An approximately 50-acre nursery lease is located in Santa Clara County. This lease contains a plant growing facility and conducts wholesale selling of trees, shrubs, flowers, and ground cover. The lease is bordered on one side by Los Trancos Creek. As a nursery operation, the lessee is continuously replanting plants and trees into larger containers and storing them on site until sale. Potting materials are brought on-site from other facilities. The materials used are horse stables sweepings (pine chips and manure), redwood shavings, sand, and topsoil. The products are mixed on-site and put into the containers with the plant. Synthetic fertilizer is top-dressed in the containers at the time of planting. There are several buildings on-site that house the office and storage facilities. There also is an extensive irrigation system.

The animal waste and composting material used for planting are not generated on site. They are imported to the site on an as-needed basis. Stockpiled sweeping/compost piles are stored at several locations; one is located approximately 300 feet away from Los Trancos Creek. The piles that contain animal waste are covered and surrounded by a berm to prevent water runoff from entering the stockpile area.

Vineyard. In the late 1990s, an approximately 10-acre vineyard was planted on Stanford lands in San Mateo County, at the site of a former Christmas tree farm. This site abuts an extensive riparian forest associated with Sausal Creek and several unnamed seasonal tributaries.

3.8.1.1 Potential Effects of Agricultural Uses on the Covered Species

Under existing water quality regulations, run-off cannot impair water quality in the creeks. Intensive agricultural uses that are adjacent to or near creeks can result in waterway contamination from pesticides and fertilizers used during farming, and the erosion of loose soils could increase the amount of sedimentation in creeks. Additionally, it is probable that individuals of Covered Species, primarily red-legged frogs and western pond turtles, occasionally wander into areas of intensive agriculture and are subsequently harmed or killed.

Ranch/Farm. Existing water quality regulations prohibit run-off to the creeks that would adversely affect water quality.

Ground disturbing activities associated with normal farming activities could harm western pond turtle and California red-legged frogs that stray out of the riparian habitat and into farmed areas. California tiger salamanders and garter snakes have not been found in farmed areas, or in areas immediately adjacent to farmed areas.

Nursery. Existing water quality regulations prohibit run-off to the creeks that would adversely affect water quality and therefore do not adversely affect steelhead. California red-legged frogs could be killed or harmed if they dispersed into nursery operations. California tiger salamanders, garter snakes, and western pond turtles are not located near the nursery area and it does not provide potential habitat.

Vineyard. Covered Species have not been recorded from the immediate vicinity of the vineyard. It is therefore unlikely that operation of the vineyard would have a direct effect on the Covered Species. Existing water quality regulations prohibit run-off to the creeks that would adversely affect water quality.

3.8.2 Equestrian

Approximately 1,200 acres of Stanford's lands are leased or licensed for equestrian-related activities, including facility-intensive horse boarding and training, and less intensive open pasture and trails (Figure 3-3). A number of boarding and training facilities are situated adjacent to riparian areas known to support the Covered Species. Likewise, many of the access roads for the equestrian facilities are located adjacent to creek banks. Manure and other refuse is collected from the equestrian facilities on a regular basis, stored on-site in piles, and removed for disposal every few days. The refuse piles are covered during the rainy season and are located a minimum of 150 feet from the top of any creek bank.

Horse pastures at Stanford are typically fairly flat, although there are a number located on steep hillsides. Grazing intensity varies, but in many years grazing is insufficient and supplemental feed must be provided.

Pastured horses have limited direct access to Deer and Matadero creeks. Equestrian trails are located throughout the undeveloped portions of Stanford. Trails cross creeks via unimproved crossings only in one location in the San Francisquito watershed and at several locations in the Matadero/Deer watershed. These crossings tend to be sites where erosion and horse waste impact water quality. During the last decade, Stanford has eliminated several unimproved creek crossings by constructing a new bridge at Webb Ranch, replacing an existing but decrepit bridge at Glen Oaks, and realigning the horse trail at Webb Ranch and Jasper Ridge Biological Preserve away from the San Francisquito Creek bank.

Horse washing facilities are present in all of the equestrian operations. The horse washing facilities are located more than 150 feet from the top of any creek bank.

3.8.2.1 Potential Effects of Equestrian Uses on the Covered Species

Equestrian-related activities could adversely affect steelhead, California red-legged frogs and western pond turtles by contaminating water sources with animal waste. These impacts are particularly problematic in locations that have stables and paddocks adjacent to the top of creek banks, grazing on steep slopes, and horses that have direct access to creeks (in some pastures and where trails cross creeks). In addition, horses could trample Covered Species, especially in locations that the horses cross the creeks.

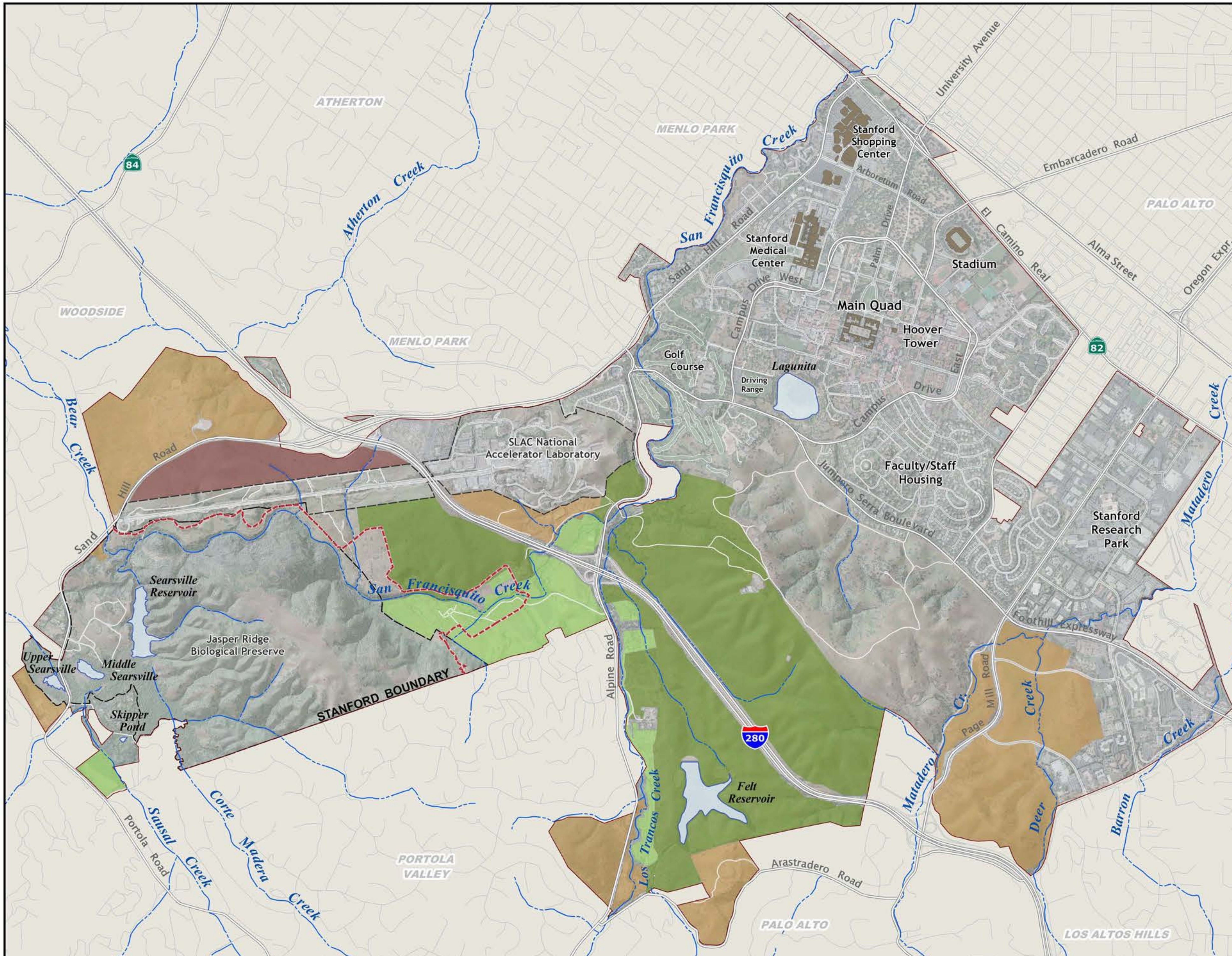
3.8.3 Grazing

Stanford maintains grazing leases on approximately 1,000 acres in the foothills (Figure 3-3). Grazing reduces the fuel load and is important for fire hazard reduction. Cattle in individual leaseholds typically free range over several hundred acres. Water troughs and salt licks are scattered throughout the cattle grazing areas and cattle have direct access to several of the minor seasonal creeks. Major creeks are fenced to prevent access by cattle.

3.8.3.1 Potential Effects of Grazing on the Covered Species

Managed grazing generally benefits grassland ecosystems. At Stanford, cattle have not grazed in most of the foothill areas that are occupied by California tiger salamanders and garter snakes since the mid-1980s. The foothill areas that are currently grazed are generally too far from Lagunita to provide upland habitat for California tiger salamanders that breed in Lagunita and garter snakes have not been observed in these areas. Some grazing activity is located adjacent to riparian areas and could result in impacts such as erosion of loose soils that could increase the amount of sedimentation in the creeks, or trampling of dispersing California red-legged frogs.

Stanford University Habitat Conservation Plan



Leaseholds: Agricultural & Equestrian

- Agriculture
- Equestrian
- Licensed equestrian trail
- Grazing
- Vacant

hectare
100
25
4
acres

Sources:
Leases: Stanford Management Co. & SU/PO, 2006
Creeks: US Geological Survey, 1991

Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 0.5 Miles
0 0.25 0.5 0.75 1
Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 3-3

3.9 COMMERCIAL AND INSTITUTIONAL LEASEHOLDS

3.9.1 SLAC National Accelerator Laboratory

The Stanford Linear Accelerator Center (SLAC) was founded in 1962 and the construction of the 2-mile-long accelerator was completed 4 years later in 1966 (Figure 3-4). A decade after SLAC was founded, the Stanford Synchrotron Radiation Laboratory (SSRL) was established as a National Users' Facility. Construction of the SSRL began in 1983 and was completed in 1989. SSRL became part of SLAC in 1992, and in 1994, the PEP II project was initiated, to build the Asymmetric B Factory. The facility was renamed the SLAC National Accelerator Laboratory in 2009.

SLAC is a national research laboratory, probing the structure of matter at the atomic scale, and at much smaller scales with electron and positron beams. The laboratory is operated by Stanford University under a contract from the United States Department of Energy (DOE) and the site is ground leased by Stanford to the DOE. As the property owner, Stanford would continue to perform some activities at the SLAC site, such as landscaping, grounds maintenance, and drainage management.

3.9.1.1 Potential Effects of SLAC Activities on the Covered Species

SLAC is a federal facility and federal activities at the SLAC site, including the modification or expansion of any SLAC facilities, are not covered by this HCP. However, outdoor activities carried out by Stanford at SLAC, such as landscaping, grounds maintenance, and drainage management, are covered by the HCP. Potential conflicts between federally listed species and new or ongoing uses at SLAC would be addressed through a "Section 7" consultation between the DOE and the Service. If the SLAC lease, or a portion of the leased property, reverts to Stanford during the life of this HCP, it will automatically be subject to the HCP, and any subsequent land uses and activities will be carried out in accordance with the terms of the Stanford HCP. The SLAC site is in a generally developed area. However, landscaping and similar outdoor maintenance activities could adversely affect individual California red-legged frogs, garter snakes, and western pond turtles that happen to enter the area from adjacent riparian areas.

3.9.2 Independent Research Institutions

A small number of sites located in the "Lathrop" district of the University, in Santa Clara County, south of Junipero Serra Boulevard, are leased to independent research institutions. These sites are within or adjacent to California tiger salamander upland habitat and include improvements typically associated with academic facilities: buildings, roads, paths, parking lots, lighting, etc. Although many of these sites incorporate non-irrigated native plant landscaping, they also include managed landscapes primarily intended for human uses, and include irrigated non-native plants, furnishings, paving, and recreational facilities.

3.9.2.1 Potential Effects of the Independent Research Institutions on the Covered Species

Maintenance and operation of independent research institutions located in the undeveloped portions of campus can result in the take of Covered Species. California tiger salamanders and garter snakes are more vulnerable to impacts from these institutions because they are located in areas that provide upland habitat for these two species. Maintenance of the facilities involves landscaping and utility work, both of which often involve earth moving and vegetation modification. Rodent control also is a necessary part of the management for these institutions, but is limited to the immediate proximity of the buildings. Digging, vegetation removal, and rodent control can take California tiger salamanders. Likewise, unless adequately fenced or covered, short-term trenches can act as traps for dispersing California tiger salamanders, and inappropriately placed structures can act as barriers.

3.9.3 Commercial Leases

There are many urban leases on Stanford lands, primarily in Palo Alto and Menlo Park (Figure 3-4). These leases include the Stanford Research Park, Stanford University Medical Center, Stanford Shopping Center, commercial housing, and other commercial uses. These leases are all located in developed urban areas.

3.9.3.1 Potential Effects of the Commercial Leases on the Covered Species

These leases are for fully developed properties. The ongoing use, maintenance, and re-development of these properties would not have direct effects on the Covered Species. However, stray California tiger salamanders, garter snakes, and California red-legged frogs are occasionally found scattered throughout campus and could be affected by urban activities at these fully developed properties.

3.10 FUTURE CAMPUS DEVELOPMENT

Under the HCP, the future development of Stanford land is a Covered Activity. Potential future development includes new academic, academic support, residential, athletic, and commercial facilities. As discussed in more detail below, the County of Santa Clara granted Stanford a General Use Permit (GUP) that allows Stanford to develop certain lands that are located in unincorporated Santa Clara County. Stanford does not have any specific plans to develop additional land that supports Covered Species, beyond the development permitted by the GUP.

However, the Covered Activities include additional future development that could occur during the life of the HCP. This additional development also will require discretionary permits from state and local agencies, which in turn could trigger compliance with state and local regulations, including environmental review under the California Environmental Quality Act (CEQA).

Future development in areas that are already developed, and which do not provide habitat for or support the Covered Species, would not have direct effects on the Covered Species. However, stray California tiger salamanders, garter snakes, and California red-legged frogs are occasionally found scattered throughout campus and could be harmed by future development even in the developed areas.

3.10.1 Development Associated with Santa Clara County 2000 GUP

The development permitted by the GUP is currently anticipated to be completed in approximately 10 years. Most of the development permitted by the GUP will be infill development. However, development could conceivably occur in areas that provide habitat for the Covered Species, primarily California tiger salamander and garter snake habitat. Under the GUP, Stanford could develop land that is occupied by the Covered Species or that provides potential habitat for the Covered Species. For the purposes of analysis, this HCP anticipates that development under the 2000 GUP could result in the removal of 30 acres of habitat.

The remainder of the allowed academic, academic support, and residential development allowed under the GUP will occur in already developed portions of the campus, which do not provide habitat for, or support, the Covered Species. This infill development generally would not adversely affect the Covered Species; however, stray California tiger salamanders, garter snakes and California red-legged frogs occasionally migrate into these developed areas. Therefore, future in-fill development in the central campus is a Covered Activity.

3.10.1.1 Potential Effects of Development under 2000 GUP on the Covered Species

All of the potential environmental impacts of the GUP were addressed in an Environmental Impact Report (EIR) certified by the County of Santa Clara in December 2000. The EIR contains a detailed analysis of the impacts of the GUP on various resources including biological resources. In summary, the EIR found that the academic and residential development permitted under the GUP would result in a minimal amount of take of California red-legged frogs and steelhead, primarily by way of habitat modification. The approved development would result in a loss of California tiger salamander habitat, as well as potential loss of individuals due to direct mortality or reduction of reproductive success (i.e., inability of adults to reach breeding sites, inability of juveniles to disperse to upland habitat).

The EIR imposed several Conditions of Approval to reduce the impacts on these Covered Species to less than significant. One of these Conditions recognized the potential future Stanford HCP, and this HCP will fulfill GUP Condition J.9 as soon as it is approved by the Service:

> *"Condition J.9. If the CTS is listed as threatened or endangered under the federal Endangered Species Act or any successor statute with the purpose of protecting endangered or threatened species, an appropriate permit will be obtained from the USFWS . The conditions of the GUP that address California tiger salamanders shall be superseded by any subsequent Habitat Conservation Plan (HCP) approved by the USFWS, so long as the HCP provides at least as much habitat value and protection for CTS as these Conditions of Approval." (page 24)*

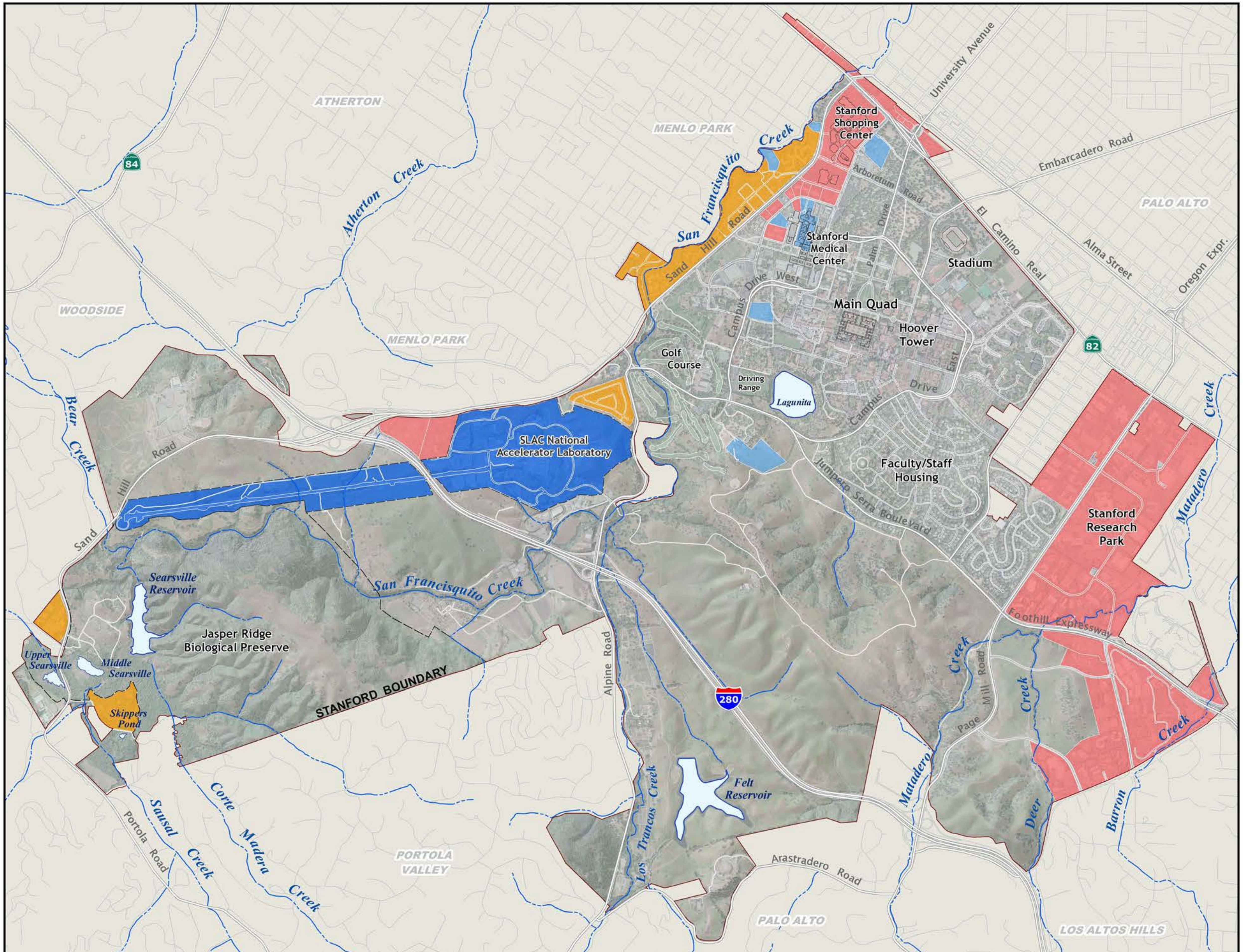
At the time of the HCP drafting, none of the academic or residential GUP projects with the potential to impact the California tiger salamander had been proposed or constructed. However, several conditions of approval had been fulfilled, including the construction of eight new breeding ponds south of Junipero Serra Boulevard (JSB) and three amphibian tunnels across JSB.

Future development was also addressed through the California Tiger Salamander Management Agreement, approved by the CDFG, the Service, and Santa Clara County in June 1998. This agreement was entered into before California tiger salamanders were protected under the ESA, and does not provide incidental take authorization. However, the Management Agreement provides conservation guidelines that have been incorporated into the HCP's Conservation Program (Section 4.0). The HCP will supersede the California Tiger Salamander Management Agreement.

3.10.2 Development Beyond the Santa Clara County 2000 GUP

The GUP will expire when development covered by the permit has been completed. Prior to its expiration, Stanford will determine its needs for housing, educational facilities, recreational facilities, etc., for the next planning horizon. Future development up to at least 2025 will be guided by Stanford's Community Plan and the existence of the Academic Growth Boundary that was established in 2000. The Academic Growth Boundary restricts virtually all academic growth in unincorporated Santa Clara County to the currently developed portions of campus (primarily north of Junipero Serra Boulevard).

The land use designation for San Mateo County lands are open space/institutional/future study area. The underlying zoning designation is RE/S11, residential estate. This zoning allows housing on a 1-5 acre minimum lot determined by slope. Higher density residential development, non-profit facilities, and farming may also be permitted with a conditional use permit.



Stanford University Habitat Conservation Plan

Leaseholds: Commercial & Institutional

- Commercial
- Institutional/ Professional
- Residential
- SLAC

hectare

100
25
4
acres

Sources:
Leases: Stanford Management Company & SU/PO, 2006
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Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 3-4

Planning for the future development of Stanford's lands outside of Santa Clara County, and in Santa Clara County beyond the GUP, was estimated based on current planning principles of density and building efficiency. These assumptions present a reasonable forecast of future development during the 50-year life of the HCP; however, actual development could vary from these predictions. Specific future building projects have not been identified at this time, and the forecast is based on the distribution of potential building sites within currently undeveloped land.

In accordance with current planning principles of density and building efficiency, as well as economic and research uncertainties, the HCP forecasts that Stanford could develop 1-3 acres per year of land that provides habitat for, or is occupied by, the Covered Species. Development at this rate would result in a total development of 50-150 acres over the 50-year life of the HCP. This development likely would not occur in regular increments annually, but would more likely occur as a 30-acre project every decade, or a 15-acre project every 5 years, at a maximum.[8] It could also occur as small operational projects that result in permanent conversion of habitat.

3.10.2.1 Potential Effects of Future Development on the Covered Species

The future development beyond the GUP could remove approximately 50 to 150 acres of land that is either occupied by the Covered Species or that provides habitat for the Covered Species. This represents 2 percent to 4 percent of the Covered Species' habitat, and would not affect the persistence of any of the Covered Species. However, reducing the amount of available habitat could reduce the future maximum size of the species' populations. Construction activities could result in the take of Covered Species. Species that became trapped in a construction area could be killed or harmed by construction related equipment, and future development could result in new barriers to migration. This would result in the loss of individuals due to direct mortality or reduction of reproductive success if adults were unable to reach breeding sites or juveniles are unable to disperse to upland sites.

3.11 HABITAT MANAGEMENT, MONITORING, AND ENHANCEMENT

Chapter 4 of the HCP describes the Conservation Program that Stanford will adopt in order to contribute to the recovery of the Covered Species, and to minimize the effects of the Covered Activities and mitigate for the unavoidable adverse effects of the Covered Activities on the Covered Species. Under the Conservation Program, Stanford will actively manage, monitor, and enhance some of its land for the Covered Species and will undertake numerous activities to reduce the potential effects of the Covered Activities on the Covered Species. These management, monitoring, and enhancement activities include the preservation of areas that are important for the long-term survival and persistence of the Covered Species, surveys for Covered Species and invasive species, water quality monitoring, revegetation, vegetation management, erecting fences if needed to protect the Covered Species, construction of new wetlands suitable for California tiger salamander reproduction, and employing adaptive management to modify or introduce new management techniques. Many of these activities will occur in the most biologically sensitive areas, where the Covered Species are located.

Specific management and monitoring activities that could affect Covered Species include the activities described below.

Surveys. Surveys will be conducted for Covered and non-native species. Methods include day and night visual surveys, snorkeling, dip netting, trapping, and electrofishing.[9]

Pond construction. Pond construction includes grading activities to create the pond, planting of native materials and/or hydroseeding, and inoculating the new wetlands with appropriate species of aquatic invertebrates.

Creation of cover piles. This includes use of logs or rocks inserted into the ground. These attract ground squirrels and are useful in enhancing California tiger salamander upland habitat.

Modification of creek banks. A number of management and monitoring activities could affect the creek bank, including bank stabilization, erosion control, removal of barriers in the creek, restoration planting, and removal of non-native plants.

Relocation of "salvaged" individual Covered Species. The Conservation Program includes the relocation of individuals found in harm's way (e.g., in urbanized areas or in side pools or ponds that were isolated and/or drying prematurely) to safer locations within protected areas.

Control of non-native species. The Conservation Program includes ongoing surveys for non-native species, and the removal of non-native animal species will occur through hand capture, trapping, and electrofishing, as described in Section 4.3.1.2 San Francisquito/Los Trancos Easement Monitoring and Management Plan, Section 4.3.2.2 Matadero/Deer Easement Monitoring, Section 4.3.3.2 CTS Reserve Monitoring and Management Plan, and Section 4.6 HCP Monitoring Program. Control of non-native plant species includes mowing, hand removal, grazing, and the spot application of herbicide if hand removal is not effective or is not feasible because of the range of the infestation.

[8] Assuming a lower density campus development of 0.25 Ground Area Coverage and two-story buildings, 1-3 acres would support 20,000 to 60,000 gsf of academic development. Assuming a housing density of 4-5 single-family units per acre, 1-3 acres would support 4-15 housing units each year. Thus, during the life of the HCP, approximately 1,000,000 to 3,000,000 gsf of academic development, or 200-750 single-family housing units, or some combination of the two (e.g., 1,000,000 gsf of academic development and 400-500 housing units) could occur.

[9] Electrofishing is a NOAA-approved method of temporarily immobilizing steelhead for monitoring or relocation purposes.

3.11.1 Potential Effects of Habitat Management, Monitoring, and Enhancement on the Covered Species

The management, monitoring, and enhancement activities associated with the Conservation Program will benefit the Covered Species. Although the long-term effect of these activities will be beneficial to the Covered Species and their habitat, the activities could result in the incidental take of the Covered Species.

Surveys. Day and night visual surveys, and snorkeling, will not impact California tiger salamanders. Use of these methods does have the potential to temporarily alter the behavior of steelhead, California red-legged frogs, garter snakes, and western pond turtles, because these species typically attempt to avoid humans by either finding cover or by leaving the immediate vicinity of the person conducting the survey. These effects are minor and generally limited in duration to the brief periods during which the observer is surveying a particular area. Dip netting, trapping, and electrofishing each have the potential to impact the Covered Species. However, if employed with caution, the level of take associated with each of these techniques is minor. Dip netting has the least potential to cause take, but it should be expected that such activities will cause the take of several larval California tiger salamanders and California red-legged frogs, and small steelhead. Dip netting will not affect western pond turtles or garter snakes.

The proposed survey trapping for larval California tiger salamanders involves the use of aquatic minnow traps and is live trapping. No individuals of any species are released until positive identification is made. Trapping is very unlikely to affect California red-legged frogs or western pond turtles because they are not located at Lagunita or the foothills ponds. Garter snakes could become trapped in the shallow traps. Research at Stanford in the 1990s found that steelhead survive being temporarily trapped quite well. Larval California tiger salamanders may exhibit some cannibalism while being held in traps, and invertebrate predators that find their way into traps have been observed to eat amphibian larvae. Being held in a live trap does pose a risk of take, but the potential for take is minimized by frequent checking of the traps and discontinuing the use of the traps if predation or some other factor, such as water quality, becomes a problem.

Electrofishing will not affect California tiger salamanders, and it is very unlikely to affect western pond turtles. While electrofishing will not be used in areas where California red-legged frogs or garter snakes are expected, there is a slight chance that California red-legged frogs will be encountered. If California red-legged frogs or garter snakes are unexpectedly encountered, electrofishing will stop, and the effects on these species will be limited to the very short time period during and just after they are discovered. The effects of electrofishing on California red-legged frogs are generally limited to harassment, and should not result in the death of California red-legged frogs. Inadvertent electrofishing is not anticipated to result in the death of a garter snake. Electrofishing will take a small number of steelhead. Take is generally limited to harassment (e.g., stunning the fish), but can cause death. Take will be minimized by following the NOAA Fisheries' "Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act, June 2000."

The spread of pathogens is always a risk when field workers go from one site to the next, particularly in aquatic systems. However, there is very little risk of this problem at Stanford because the equipment (e.g., waders, nets, etc.) used to monitor the Covered Species at Stanford are only used at Stanford or in the immediate vicinity of the University (and all off-campus sites are within the same watersheds which occur at Stanford). Additionally, equipment used in aquatic surveys is typically washed and dried after each use.

Pond construction. The creation of new, off-channel, wetlands will not affect steelhead. Construction of such wetlands could potentially affect western pond turtles, garter snakes, or California red-legged frogs, but preconstruction surveys and project siting considerations will essentially eliminate the chance of take of these species. A limited amount of take of California tiger salamanders, however, is likely when ponds are constructed for California tiger salamanders because the location of the new ponds will likely be in areas that are already occupied by California tiger salamanders and in areas where burrowing rodents are present. With preconstruction surveys and hand excavation of extensive burrow systems, take of California tiger salamanders during future pond construction will be minimized, and on the order of one or two salamanders per new pond. If the new ponds are located at the edge of occupied uplands, then the estimated number of California tiger salamanders impacted by construction activities is further reduced, but these more peripheral ponds will likely take longer to be used by California tiger salamanders.

It is possible that the wetlands could have hydrologic features which cause the wetland to act as population sinks for the Covered Species. As part of the long-term adaptive management program this possibility will be evaluated on a case-by-case basis, and any pond found to have significant negative effects on California tiger salamanders will be modified or eliminated.

Creation of cover piles. Construction of cover piles will not affect steelhead or western pond turtles. Construction of cover piles in or near riparian zones could potentially affect California red-legged frogs and garter snakes, but cover piles would only be constructed in locations noticeably lacking in cover that are very unlikely to support either species. The construction of cover piles in California tiger salamander-occupied uplands could affect California tiger salamanders. Preconstruction surveys, hand-excavation of extensive rodent burrows, and flexibility in where to exactly site the cover piles

(they will be sited to avoid locations where construction would cause take) reduce the chance of take.

It is possible that the cover piles could attract predators, competitors, non-native species, or other biological elements that cause take of the Covered Species. As part of the long-term adaptive management program, this possibility will be evaluated on a case-by-case basis, and any cover pile found to have significant negative effects will be removed.

Modification of creek banks and channel. Work on the creek banks or channel will not affect California tiger salamanders, but could affect California red-legged frogs, garter snakes, western pond turtles, and steelhead.

Relocation of "salvaged" individual Covered Species. Relocating individual Covered Species presents a risk that an individual will be harmed or killed. However, the relocation of individual Covered Species is only contemplated if that individual is already at risk of being harmed or killed, and the amount of take associated with moving it is less than leaving it in the original risk-causing situation. California tiger salamanders are the most likely of the Covered Species to benefit from relocations as they frequently encounter human-built structures, including roads, during their rainy season migrations. Numbers of California tiger salamanders potentially handled during each year varies considerably (largely dependent on weather), and ranges from several hundred individuals to be moved off of roads, to a few individuals inadvertently trapped in utility boxes or drains. The release sites are chosen carefully. For example, in the 1990s, most utility box rescues occurred in the dry season, and the rescued California tiger salamanders were released in relatively damp areas or at the entrance of rodent burrows. While such dry season relocations do present risk, leaving the individual California tiger salamanders trapped in utility boxes is virtually guaranteed to result in death of the individual. Additionally, the relocation of individual California tiger salamanders should not affect California tiger salamanders that already inhabit the release area.

During the last decade of active conservation work at Stanford, no California red-legged frogs or western pond turtles were found in situations that required relocation. In the future, as the population of these Covered Species increases, they could require relocation. Care will be taken to minimize the potential for take by handling the species as little as possible and choosing the release site carefully.

A few steelhead, particularly small parr and smolts, become trapped in naturally rapidly drying portions of the creek or in areas around structures each year. Relocating these individuals to the nearest appropriate habitat can cause take, but the alternative is dying by desiccation or predation.

Control of non-native species. Trapping of non-native animal species can cause the inadvertent take of the Covered Species if they are present. Non-native animal species control will not affect California tiger salamanders, garter snakes, and western pond turtles. Steelhead and California red-legged frogs, particularly California red-legged frog tadpoles, may be harassed by non-native species control activities. The proposed trapping involves the use of aquatic minnow traps and is live trapping. No individuals of any species are disposed of until positive identification is made. Being held in a live trap does increase the risk of being eaten or injured by aquatic predators, but this is minimized by frequently checking the traps and discontinuing the use of the traps if predation becomes a problem.

Control of non-native plant species will not affect steelhead or western pond turtles. California red-legged frogs and garter snakes could be affected by the removal of non-native plants in the riparian zone. Such impacts will be short term and non-lethal. Dry season mowing will not affect any of the Covered Species, including California tiger salamanders. Discing has the potential to kill California tiger salamanders, but discing is only allowed in areas where the expected density of California tiger salamanders and garter snakes is very low.

SECTION 4
CONSERVATION PROGRAM

4.0 CONSERVATION PROGRAM

Section 4.0 of this HCP describes the Conservation Program that has been developed to avoid and minimize the potential adverse effects of the Covered Activities on the Covered Species, and the mitigation measures that will fully mitigate for the unavoidable take of Covered Species. The goal of this Conservation Program is to minimize the potential adverse effects of the Covered Activities described in Section 3, and to enhance the overall quality of habitat at Stanford for the Covered Species. The implementation of this Conservation Program will provide an overall benefit to the Covered Species, despite the ongoing and future Covered Activities. This section also implements Stanford's Biological Goals and Objectives, which are described in Section 1.5.2.

All Stanford lands have been divided into management zones, based on their intrinsic value to the Covered Species. Additionally, the potential habitat areas for the Covered Species have been divided into three geographical areas: the San Francisquito/Los Trancos Creek Basin, the Matadero/Deer Creek Basin, and the California Tiger Salamander Basin. Stanford will establish three corresponding Preserved Areas to preserve large areas of biologically sensitive habitat within each of the Basins. The HCP also describes the Monitoring and Management Plans that will be implemented for each of the Preserved Areas, as well as minimization measures that will be used to reduce impacts (Figure 4-1).

4.1 CREATION OF MANAGEMENT ZONES

The HCP classifies Stanford's lands into four management zones according to the habitat value of the land, if any, to the Covered Species. The four zones and the quality of habitat they provide are discussed below. Figure 4-2 depicts the location of these zones.[1]

[1] All of the spatial data presented in this document was projected into Stateplane Coordinate System, California Zone III, NAD 83, using Geographic Information Systems (GIS). Acreage calculations appearing in this HCP may be different than previously published data due to differences in the methods used to determine acreages. The HCP covers all Stanford University owned lands, including the SLAC National Accelerator Laboratory (SLAC) and land around SLAC that is subject to a federal lease for the facility.

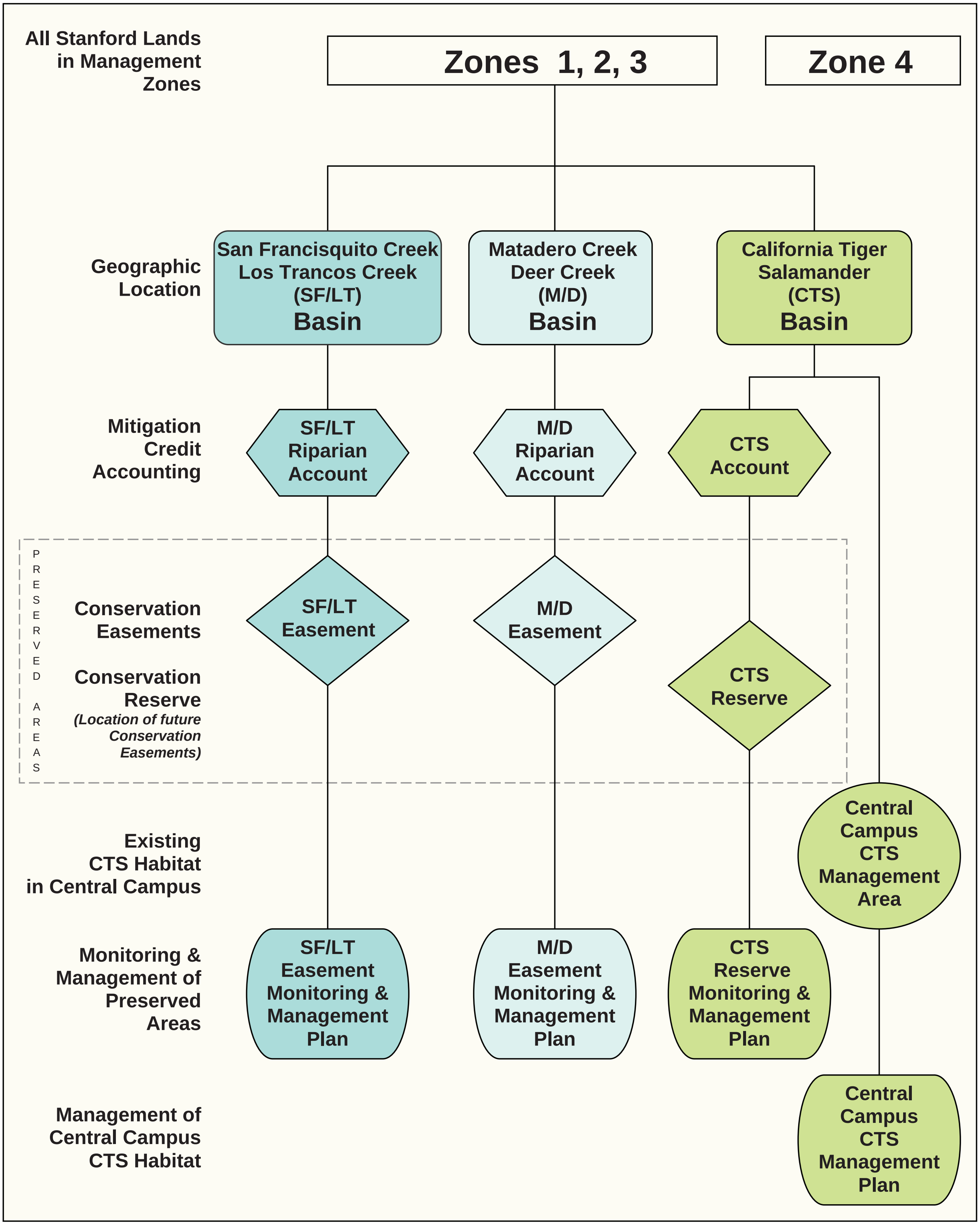
Zone 1: Areas classified as Zone 1 support one or more of the Covered Species or provide critical resources for a Covered Species. These areas are necessary for the local persistence of the Covered Species. A few areas that are currently degraded by the presence of a temporary land use also are included in Zone 1 if they are located in a place deemed critical for the long-term persistence of a Covered Species. If managed, or in some places enhanced, Zone 1 areas could support higher densities of the Covered Species. Development in Zone 1 will be avoided to the maximum extent feasible. Some areas in Zone 1 will be subject to extensive restoration and enhancement. There are approximately 1,295 acres in Zone 1.

Zone 2: Zone 2 areas are occasionally occupied by a Covered Species and provide some of the resources used by the Covered Species. These areas generally do not support individuals of the Covered Species on a year-round basis, but they provide indirect support to the Covered Species by providing a buffer between Zone 1 areas and areas that are impacted by urban and other uses. Zone 2 does not include any breeding habitat for the Covered Species. Under this Conservation Program, most of these areas will be maintained in a manner that will preserve their habitat values, and some portions of Zone 2 may be enhanced to more directly support Covered Species. When feasible, land in Zone 2 will not be developed. There are approximately 1,260 acres in Zone 2.

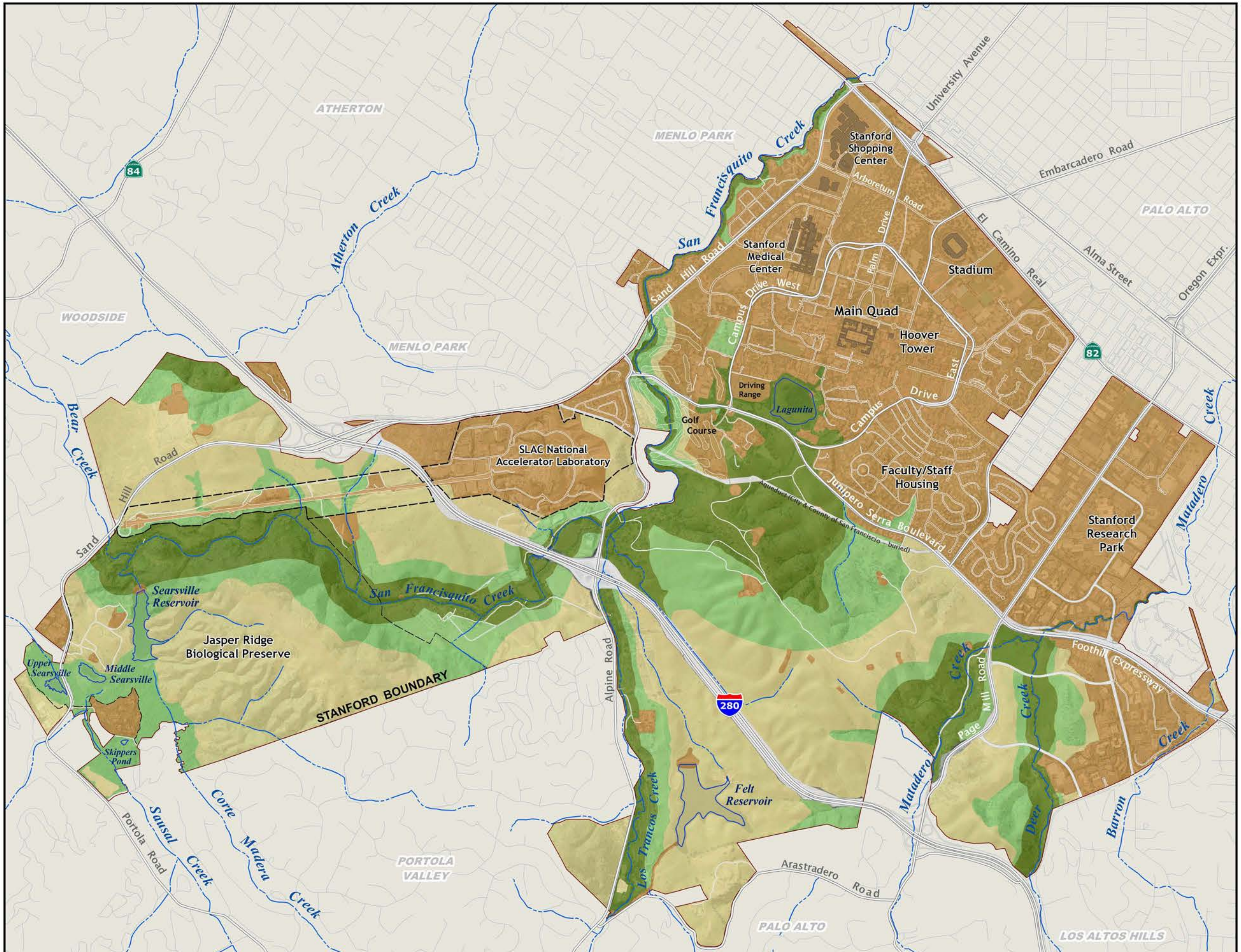
Zone 3: The lands in Zone 3 are generally undeveloped open space lands that have some biological value, but provide only limited and indirect benefit to the Covered Species. Under the Conservation Program, these areas will be operated and developed in a manner that does not adversely affect the Covered Species, but these lands are generally more desirable areas for future development than Zones 1 or 2. There are approximately 2,446 acres of land in Zone 3.

Zone 4: Zone 4 includes land that does not support or cannot sustain the Covered Species. This Zone includes urbanized areas that have been developed by the University or its ground lessees and those areas that are completely surrounded by urban development and/or roads, or are otherwise isolated from areas that support a Covered Species. Also designated as Zone 4 are generally small, but highly developed facilities such as the radio telescope, which are located within areas that otherwise support Covered Species. Zone 4 areas are population sinks for the Covered Species. The Conservation Program includes measures to reduce the likelihood that a Covered Species would enter Zone 4, and if an individual is found in Zone 4, it will be relocated to a more environmentally sound location by an authorized biologist. The further development of Zone 4 areas would not adversely affect any of the Covered Species. There are approximately 3,187 acres of land in Zone 4.

Stanford University Habitat Conservation Plan



Conservation Program - Structure and Terms **Figure 4-1**



Stanford University Habitat Conservation Plan

Management Zones

- Zone 1
- Zone 2
- Zone 3
- Zone 4

hectare

100
15
5

acres

Sources:
HCP Zones: Stanford University Campus Biologist, 2006
Aerial photos: Aerotopia, 1999
Creeks: US Geological Survey, 1991

Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 4-2

4.2 MEASURES TO MINIMIZE THE POTENTIALLY ADVERSE EFFECTS OF THE COVERED ACTIVITIES

Some of the University's structures and uses, particularly utility infrastructure and academic activities, are located in areas that support the Covered Species. These infrastructure systems will have to be maintained and improved during the life of the HCP. Likewise, the University engages in a number of ongoing activities that could affect the Covered Species. To avoid or minimize the impacts on Covered Species from these activities, Stanford will implement the following measures. **Unless specified otherwise, the Minimization Measures described below apply *only* to the Covered Activities when they occur in Zones 1 and 2.**

The HCP requires Stanford to undertake a wide range of conservation measures that will minimize the potential adverse effects on the Covered Species of operating the University. In a few instances, Stanford cannot predict at this time whether a particular conservation measure is necessary, or if a particular measure can be feasibly implemented. Therefore, in a few instances, the HCP requires Stanford, through the Conservation Program Manager, to determine the feasibility of undertaking certain conservation measures. For the purposes of this HCP, the terms "feasibility" or "when feasible" when discussing goals, objectives, and conservation measures, are defined as follows: The Conservation Program Manager's feasibility determination shall be made after taking into consideration, and balancing appropriately, existing technology, cost, and logistics in light of the overall purposes and goals of the HCP and the specific activity at issue. The Conservation Program Manager's responsibilities and role in implementing the HCP are described more fully in Section 6.3.2 of the HCP.

4.2.1 Water Management

Stanford conducts many water management activities. These include operating water diversion facilities, dams, reservoirs, deep wells, water and drainage piping,[2] and water quality monitoring. To avoid and minimize the impacts from these activities, Stanford will implement the following measures.

General Creek Protection Measures

- Whenever feasible, maintenance, repair, or construction of in-stream structures will be performed without the use of coffer dams or heavy equipment and will be conducted in the dry season.
- All projects in Los Trancos and San Francisquito creeks requiring dewatering will use coffer dams and only be conducted during the period between June 15 and October 15. De-watered reaches will not exceed 300 feet in channel length.
- Heavy equipment will only be operated on a dry creekbed. If feasible, heavy equipment will remain at the top of the creek bank or on a side bench. In the event that heavy equipment is required for in-stream activities, the Conservation Program Manager will conduct a visual survey along the transportation route to determine the least environmentally damaging route to the creek.
- When heavy equipment or coffer dams will be used, the Conservation Program Manager will be consulted and may assign measures that reduce the impact of the work on the Covered Species.
- During in-stream activities where fish are present, structures will be isolated from the waters of the creek with the use of coffer dams or netting. Any fishes at the structure will be collected and relocated to an appropriate location downstream or upstream from the construction site. The Conservation Program Manager will ensure that a qualified biologist will be on-site to conduct fish collections in a manner which minimizes potential risks to steelhead. Electrofishing, if used, shall be performed by a qualified biologist and conducted according to NMFS Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act, June 2000[3] (or then current guidelines).
- When in-stream activities are required, the amount of creek channel and bank impacted will be limited to the smallest area required to safely and efficiently complete the work.
- Upon completion of the work, any newly exposed surfaces will be stabilized with the appropriate ground cover (clean gravel if part of the creek channel is disturbed, geotextiles and plantings if a bank has been disturbed).
- An education program will be developed by the Conservation Program Manager and presented annually to maintenance workers. The education program will include discussion of the potential for steelhead, red-legged frogs, garter snakes and western pond turtles to be present near the in-stream facilities and actions that will encourage animals to disperse from the area prior to work.
- Erosion and pollution control measures will be implemented.

[2] There are over 200 miles of water and drainage piping running across Stanford. Although these facilities generally are used for water management, minimization measures to reduce their potential effects are covered by the *Existing Utility Measures* and *New Utility Measures*.

[3] The guidelines may be viewed at: http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf.

Water Diversions. Stanford operates the Los Trancos diversion facility and the pump station on San Francisquito Creek below the confluence with Los Trancos Creek, which includes the Felt pumps and the Lagunita pumps. Stanford modified these facilities in the 1990s to accommodate environmental and operational concerns raised by the CDFG. The resulting structures and operating procedures significantly reduced the effects that these facilities have on fish and wildlife resources in San Francisquito Creek and Los Trancos Creek. However, Stanford again modified these facilities to further enhance steelhead habitat in 2009, as described in Appendix A. To further reduce potential effects of the water diversion facilities, while at the same time protecting Stanford's local water supply, Stanford will implement the following additional measures. In addition, Water Diversion activities will be subject to the *General Creek Protection Measures*.

Water Diversion Measure

- The bypass flow rates approved in the SHEP Biological Opinion and SAA will be implemented (see Appendix A).

Creek Monitoring Facilities. To avoid and minimize the impacts from maintenance of the creek monitoring facilities, Stanford will implement the General Creek Protection Measures.

Water Reservoirs. To avoid and minimize the impacts from maintenance and operation of the Felt Reservoir and Lagunita, Stanford will implement the following measures.

Felt Reservoir Measures

- A western pond turtle education program will be developed by the Conservation Program Manager and presented annually to Felt Reservoir maintenance workers. The education program will include a protocol notifying the Conservation Program Manager if any turtles are found. Western pond turtles that are believed to have been released at Felt Reservoir by a member of the public will be captured and quarantined to assess their general health conditions to ensure that they can survive in the wild and they will be tested for pathogens. If the turtles are healthy, they may be released into more appropriate habitat. If it is not appropriate to release the turtles, they may be donated to a wildlife education facility.
- Signs prohibiting the release of any wildlife species will be posted at Felt Reservoir.
- Any dredging of sediment from Felt Reservoir will be conducted between June 15 and October 15. An on-site biological monitor will be present during any dredging. The biological monitor will have the authority to stop work if a western pond turtle is encountered and may relocate the individual to a safer location within Zones 1 or 2.
- The Conservation Program Manager will conduct a visual survey to locate high densities of treefrogs. If feasible, areas with high densities of treefrogs will not be dredged.

Lagunita Reservoir Measures

- Routine maintenance of the Lagunita drain or berm will be conducted when Lagunita is dry, in consultation with the Conservation Program Manager.
- A California tiger salamander education program will be developed by the Conservation Program Manager and presented annually to Lagunita maintenance workers. The education program will include restrictions on animal control programs and protocols for salamander identification, avoidance, immediate protection, and notification of the Conservation Program Manager. The Conservation Program Manager will have the authority to stop work if a Covered Species is encountered and may relocate the individual to a safer location within Zones 1 or 2.

Searsville Dam. Any major modification of Searsville Dam is not a Covered Activity and will not be permitted through this HCP and will require its own compliance with the ESA through Section 7 or a separate HCP. Likewise, the presence of the dam is not a Covered Activity. However, as part of the HCP, Stanford will perform the Searsville Dam Measure described below.

Searsville Dam Measure

- Stanford will commit to study the technical feasibility of fish passage alternatives at Searsville Dam within 10 years of approval of the HCP. Stanford will allocate $100,000 to conduct the feasibility study in conjunction with any Stanford, local agency, state agency, or federal agency proposed project to modify Searsville Dam, or independently if no such dam modification project is proposed within the 10-year time frame. The scope of the fish passage study will be developed in coordination with NOAA Fisheries. Fish passage alternatives ranging from installing a fish ladder at the existing dam to completely removing the dam will be evaluated. The results reached in the technical feasibility study will be incorporated into any proposed future dam modification project. Cost, environmental impacts, and other factors will also be considered in the decision whether or not to include fish passage facilities in any future dam modification project.

Water Distribution System. To avoid and minimize the impacts from maintenance and installation of water distribution pipelines, the General Infrastructure Measures in Section 4.2.5 will be implemented. If coffer dams are necessary, Stanford will follow the General Creek Protection Measures.

Water Wells. To avoid and minimize the impacts from maintenance of the wells, Stanford will implement the following measure.

Water Wells Measure

- An education program will be developed by the Conservation Program Manager and presented annually to maintenance workers. The education program will include discussion of the potential for Covered Species to be present near wells and actions that will encourage animals to disperse from the area prior to maintenance work.

Non-Operating Lagunita Diversion. To avoid and minimize the impacts from the non-operating Lagunita Diversion facility, Stanford will implement the following measures.

Non-Operating Lagunita Diversion Measures

- Stanford will restore more natural adult and juvenile fish passage by removing the Lagunita diversion facility[4] and restoring the creek channel to a more natural configuration. Stanford will initiate the removal project within 3 years of NOAA Fisheries' approval of this HCP, and anticipates that it will take 2-4 years to prepare final plans, perform the necessary studies and environmental reviews and secure the applicable federal, state, and local permits.
- Until the existing facility is removed, maintenance and/or repairs of the existing facilities will be performed without the use of coffer dams or heavy equipment and conducted in the dry season. If it is not feasible to perform the maintenance or repair work without the use of heavy equipment or coffer dams, the General Creek Protection Measures will be followed.

[4] Since the dam abutments are built into the surrounding stream banks, they could be left in place to prevent destabilization of the existing bank, or other bank stabilization structures may be needed; but, the dam, fish ladder, and concrete weir, which are of greatest concern to fish passage, would be removed.

4.2.2 Creek Maintenance Activities

To avoid and minimize the effects from creek maintenance activities, Stanford will implement the following measures. In addition, Creek Maintenance activities will be subject to the *General Creek Protection Measures*.

Creek Maintenance Measures

- Future creek bank stabilization efforts will be conducted only if a bank failure is a risk to public safety, roads and other structures, or is detrimental to steelhead, red-legged frogs, or western pond turtles. Areas of active bank collapse will be evaluated to determine the extent of the impact and if remedial actions are warranted. The Conservation Program Manager will determine the need, extent, and type of bank stabilization structure applied. The bank stabilization proposals will be submitted to NOAA Fisheries and the Service.
- When bank stabilization efforts are required, Stanford will use bioengineered structures. Rip-rap, rock, and other hardscape materials will only be used where required (e.g., areas of high scour). Gabions and treated wood may not be used in-channel or along the banks of Los Trancos or San Francisquito creeks.
- When feasible, bank failures may be addressed by grading and setting back creek bank and/or the extension or creation of flood benches consistent with the channel geometry to increase habitat diversity and increase the size of the creekside riparian zone. These more spatially invasive methods of creek bank stabilization (i.e., larger creek cutbacks) will be implemented if they are compatible with existing and future adjacent land uses and other natural resources.
- Woody debris in the creek channel and adjacent riparian zones is generally beneficial to steelhead and overall creek function, and will be left in place, unless it poses a flood or erosion hazard or is a barrier to steelhead dispersal. Except in an emergency, the Conservation Program Manager will be consulted if removal of woody debris becomes necessary. Removal will be conducted by hand unless circumstances require the use of machinery. Appropriate erosion and pollution control measures will be in effect during these removals.

4.2.3 Academic Activities

Research, teaching, and field studies are central to the University's existence. To avoid and minimize the impacts from current and future academic activities, Stanford will implement the following measures.

Academic Activities Measures

- Unless academic resources are located within sensitive biological areas (e.g., archaeological sites), academic activities that could adversely affect the Covered Species will be conducted in areas that do not contain sensitive resources.
- Open pits, trenches, and excavated areas shall be secured at the end of the daily excavation, in a manner that prevents Covered Species from entering them. The site will be secured with a solid barrier (e.g., silt fence, plywood, etc.) a minimum of 3 feet tall at the perimeter of the site, buried at least 4 inches into the ground. If the solid barrier coincides with a cyclone fence, the solid barrier will be attached to the outside of the cyclone fence. The barrier will be inspected by an appropriately trained person once a week, and repairs/replacement will be made as necessary. Smaller pits also shall be covered. If Covered Species are found within the excavation, the Conservation Program Manager will be contacted. The Conservation Program Manager will have the authority to stop work if a Covered Species is encountered and may relocate the individual to a safer location within Zones 1 or 2.
- If the academic resources to be studied are located in Zones 1 or 2, the Conservation Program Manager will review those activities that could adversely affect the Covered Species through ground disturbance, biological sampling, biological exclosures, clearing vegetation, and/or creek channel or pond disturbance.[5] If necessary, use conditions may be imposed by the Conservation Program Manager. All disturbed sites will be restored in a manner approved by the Conservation Program Manager.
- An academic site disturbance lasting longer than 1 year will be considered a permanent loss of habitat for the purposes of the HCP and will be mitigated in accordance with Section 4.4 of the HCP.

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[5] The Conservation Program Manager does not have to be consulted before undertaking academic activities that are not likely to affect the Covered Species, such as walking around Lagunita, swimming/boating in Lagunita, walking on existing trails or roads, water sampling from the creeks/Lagunita, photography, counting plants, crossing the creeks, and walking off of trails/roads during the dry season.

4.2.4 Utility Installation and Maintenance

To accommodate the people and facilities at Stanford, the University campus has been developed with a significant amount of urban infrastructure. To avoid and minimize the impacts from utility installation and maintenance, Stanford will implement the following measures. In addition, Utility Installation and Maintenance activities will be subject to the *General Infrastructure Measures* and *General Creek Protection Measures*.

Existing Utility Measures

- Underground utilities maintenance activities will be limited to the existing utility corridors to the extent feasible. However, if it is infeasible to use an existing corridor due to changes in land uses, new technology, or because of safety concerns, new utility corridors may be constructed in accordance with the New Utility Measures.
- The Conservation Program Manager will be notified before any utility line maintenance or replacement occurs within Zones 1 and 2.
- An on-site biological monitor will be present during all ground-disturbing activity in Zones 1 and 2. The biological monitor will have the authority to stop work if a Covered Species is encountered and may relocate the individual to a safer location within Zones 1 or 2.
- Heavy equipment will be used only if it is not feasible to excavate, clear vegetation, and expose the utilities by hand.
- After service, underground utility lines must be reburied as soon as possible, the original topsoil spread across the construction site, and the disturbed area seeded with native plant species.
- Erosion control devices must be implemented during underground utility maintenance activities that occur between October 15 and March 15.
- Any native trees or native shrubs that are removed will be replaced, but not necessarily in the same location.

- The disturbance to areas around existing above-ground utilities will be kept to a minimum.
- If feasible, and beneficial to the Covered Species, existing above-ground utilities will be placed underground, excluding storm drainage that may be conveyed in open ditches.
- The modification of any enclosed reservoir tank will be limited to the existing footprint of the structure to the extent feasible. Enclosed reservoir tanks may be expanded beyond the existing footprint or moved if it is not feasible to remain within the existing footprint. If it is not feasible to remain within the existing footprint, the Conservation Program Manager will be consulted and may assign measures that reduce the impact to Covered Species. Such measures may include restoration of temporarily disturbed areas. The expansion of an enclosed reservoir tank will be considered a loss of habitat requiring mitigation.[6]
- Utility trenching will be scheduled during the dry season. If utility trenching is required during the wet season (October 15-March 15), the Conservation Program Manager will be consulted and may assign measures that reduce or avoid the likelihood that the trenching areas will be a barrier and/or pitfall trap during species movement. Utility trenching in the streambed of creeks will be limited to the dry season and comply with the *General Creek Protection Measures*.
- A California tiger salamander education program will be developed by the Conservation Program Manager and presented annually to maintenance workers before any trenching or other underground maintenance work is done in Zones 1 or 2 of the California Tiger Salamander Basin. The education program will include protocols for identification, avoidance, immediate protection, and notification of the Conservation Program Manager.

[6] Open water reservoirs are addressed by the *Felt and Lagunita Reservoirs Measures*.

New Utility Measures

- The Conservation Program Manager will be consulted before new utilities are installed.
- New utilities will be sited in existing utility corridors or existing road alignments. New utilities may be sited in new utility corridors only if it is not feasible to place new utilities in an existing corridor or roadway because, for example, an existing corridor or roadway is not available, or due to changes in land uses, technology, or safety concerns. New utility corridors also may be constructed irrespective of the feasibility of using an existing corridor or roadway if the Conservation Program Manager determines the new corridor will have fewer impacts on the Covered Species than the use of an existing corridor or roadway.
- An on-site biological monitor will be present during all ground-disturbing activity in Zones 1 and 2. The biological monitor will have the authority to stop work if a Covered Species is encountered and may relocate the individual to a safer location within Zones 1 or 2.
- Any areas that are disturbed by the installation of new utilities will be restored in accordance with recommendations made by the Conservation Program Manager.
- Open pits, trenches, and excavated areas will be backfilled as soon as possible, and will be secured at the end of every work day in a manner that prevents Covered Species from entering them.
- The construction site will be secured with a solid barrier (e.g., silt fence, plywood, etc.) a minimum of 3 feet tall at the perimeter of the site, buried at least 4 inches into the ground. If the solid barrier coincides with a cyclone fence, the solid barrier will be attached to the outside of the cyclone fence. The barrier will be inspected by an appropriately trained person once a week, and repairs/replacement will be made as necessary.
- If a Covered Species is found during construction in Zones 3 and 4, the Conservation Program Manager or another biologist qualified by the Service will relocate the Covered Species to more suitable habitat in Zone 1 or 2.
- If new utility corridors are permanently cleared of vegetation (e.g., if vegetation is cleared and not replanted or allowed to naturally re-grow), it will be considered a permanent loss of habitat and mitigated in accordance with Section 4.4. Mitigation for the loss of habitat may be required for more than just the footprint of the cleared vegetation.

- Installation of new utilities within the streambed of creeks will be limited to the dry season and comply with the *General Creek Protection Measures*.
- Any area that is disturbed by new utility-related construction activities for longer than 1 year will be mitigated as a permanent loss of habitat in accordance with Section 4.4 of the HCP.

4.2.5 General Infrastructure

To accommodate the people and facilities at Stanford, the University campus has been developed with a significant amount of urban infrastructure. To avoid and minimize the impacts from current and future infrastructure, Stanford will implement the following measures. In addition, General Infrastructure activities will be subject to the *General Creek Protection Measures*.

General Infrastructure Measures

- Any new or existing general infrastructure activity within Zones 1 or 2 that is not covered by a specific measure will be reviewed by the Conservation Program Manager. The Conservation Program Manager will recommend specific measures that are consistent with the HCP to reduce or eliminate the potential adverse effects on the Covered Species. These measures may include, but are not limited to, seasonal limitations on maintenance activities, revegetation, and input on the location of new facilities.
- An education program will be developed by the Conservation Program Manager and presented annually to maintenance workers who regularly work in Zones 1 or 2 and contractor personnel before they begin work in Zones 1 or 2. The education program will address tiger salamanders, red-legged frogs, garter snakes, and western pond turtles and will include protocols for identification, avoidance, immediate protection, and notification of the Conservation Program Manager. The Conservation Program Manager will have the authority to stop work if a Covered Species is encountered and may relocate the individual to a safer location within Zones 1 or 2.
- All activities associated with the operation, maintenance, and installation of infrastructure improvements will be conducted in an environmentally responsible manner in accordance with practices outlined in current industry published manuals, such as FishNet4C (2007), Flosi et al. (1998), Lovett and Price (2007), and Pacific Watershed Associates (1994).

Paved Private Road Measures

- New paved roads within Zones 1, 2, and 3 will be considered a loss of habitat requiring mitigation, and will be sited only after input from the Conservation Program Manager. In general, no new paved road will be built in Zone 1 unless the increase in paved surfaces would benefit the Covered Species or if a new road is required for safety reasons.
- Road realignments in Zones 1 and 2 that benefit the Covered Species (e.g., moving an existing road further from a riparian zone and restoring the existing road) are considered an enhancement as described in Section 4.3. Realignments required to address safety concerns or for other reasons will require mitigation unless the Conservation Program Manager determines the new road alignment, with restoration of the old road, would serve as habitat enhancement.
- Maintenance activities on existing paved private roads will remain within the existing road footprint and will be performed consistent with industry standards for the conservation of resources.
- Vehicular access on paved private roads will be restricted to authorized personnel.
- These roads will be monitored periodically by Stanford for structural integrity, erosion, and to assess whether they are a potential barrier to wildlife dispersal.
- Proposed streetlights, drains, or curbs will be reviewed by the Conservation Program Manager, and if they would adversely affect the Covered Species, they may be approved only if they are required for safety reasons.
- Paved private roads will be "storm-proofed" to minimize runoff of sediments and contaminants from roads to riparian areas and creeks using principals, procedures, and prescriptions described in FishNet4C (2007) or then current guidance.
- Maintenance of paved private roads and shoulders will be conducted using principals, procedures, and prescriptions described in FishNet4C (2007) or then current guidance.

Unpaved Service Road Measures

- New unpaved roads within Zones 1, 2, and 3 will be considered a loss of habitat requiring mitigation, and will be sited only after input from the Conservation Program Manager. In general, no new unpaved road will be built in Zone 1, unless the increase in unpaved surface would benefit the Covered Species or if the new unpaved road is required for safety reasons.

- Re-surfacing with gravel or compacted dirt will be the preferred repair treatment. Any other materials must be approved by the Conservation Program Manager prior to use.
- Access on unpaved service roads will be restricted to authorized personnel.
- No streetlights or curbs will be constructed on unpaved service roads.
- Service roads will be monitored by Stanford at the end of the rainy season for structural integrity, erosion, and to assess whether they are a potential barrier to wildlife dispersal.
- Changes to road alignments and any new roads will be reviewed by the Conservation Program Manager and designed to meet appropriate conservation standards (e.g., Flossi et al. 1998, National Marine Fisheries Service 2000, Pacific Watershed Associates 1994).
- Unpaved private roads will be "storm-proofed" to minimize runoff of sediments and contaminants from roads to riparian areas and creeks using principals, procedures, and prescriptions described in FishNet4C (2004 and updated 2007) or then current guidance.
- Maintenance of unpaved private roads and shoulders will be conducted using principals, procedures, and prescriptions described in FishNet4C (2004 and updated 2007) or then current guidance.

Private Bridge Measures

- If a bridge becomes structurally unsound and must be replaced, the replacement bridge will be at maximum the same width, unless public safety, environmental, or other legal issues require an increase in size; and in the same location. Stanford will consider replacing an unsound bridge at a more environmentally appropriate location, if there is such a location and it is feasible. Future bridge designs will be consistent with NOAA Fisheries' Guidelines for Salmonid Passage at Stream Crossings (National Marine Fisheries Service 2000).
- For bridge repairs and new bridges over creeks, construction will be limited to the dry season and comply with the General Creek Protection Measures.
- If an existing bridge is removed, the area will be restored under the supervision of the Conservation Program Manager.
- Vehicular and foot traffic on private bridges will be restricted to authorized uses.
- If a new bridge is needed, Stanford will consult with the Conservation Program Manager to design the new bridge in a manner that minimizes the effects of the bridge on riparian resources. Additional bridges are strongly discouraged; however, replacing culverts or low-water crossings with bridges is encouraged. Future bridge designs will be consistent with NOAA Fisheries' Guidelines for Salmonid Passage at Stream Crossings (National Marine Fisheries Service 2000).

Fence Measures

- Any new fences will be designed in consultation with the Conservation Program Manager to minimize potential barriers to general wildlife dispersal. However, fences will allow dispersal by Covered Species except where such dispersal would be detrimental to the species.
- Derelict fences will be removed.

Detention Basin Measures

- After any major runoff producing event, the Conservation Program Manager will survey the storm water detention basins to verify that they are draining. If the ponding lasts longer than 2 days, the Conservation Program Manager will visually survey the basins for the presence of California tiger salamander, and if any California tiger salamanders are found, the Conservation Program Manager will relocate them to more suitable habitat.
- The Conservation Program Manager will be consulted before new off-channel flood control facilities (including any detention or retention basins) are installed. New in-stream facilities are not a Covered Activity.
- Any areas that are disturbed by the installation of new flood control facilities will be restored in accordance with recommendations made by the Conservation Program Manager.

Isolated Private Residence Measures

- No building additions or expansion of paved surfaces will be allowed in Zone 1.
- If a private residence located in Zone 1within 150 feet of the creek is substantially damaged in a fire, earthquake, flood, or other calamity, it may be rebuilt in Zone 1, but farther from the creek; however, rebuilding in Zones 2, 3, or 4 is preferable. The original residential location will be restored to riparian habitat. If a private residence is rebuilt under this provision, the mitigation provisions set forth in Section 4.4 will not apply.

Academic Buildings Measure

- If a Covered Species is found during maintenance of academic buildings, the Conservation Program Manager will relocate the Covered Species to more suitable habitat in Zone 1 or 2.

4.2.6 Recreation and Athletics

The University has many recreational and athletic facilities that are used by students, faculty, and the public. The most well-known recreational facility is the Stanford golf course. However, in addition to the golf course and driving range, Stanford has miles of trails and pathways that are used for horseback riding, hiking, biking, jogging, and similar recreational activities. Measures to reduce or eliminate the potential effects of these facilities on the Covered Species are set forth below.

Stanford Golf Course. The Stanford golf course has been in place for nearly 80 years, and requires extensive ongoing management. To avoid and minimize the impacts from current and future golf course activities, Stanford will implement the following measures.

Golf Course Measures

- Potential effects on steelhead, red-legged frogs, and western pond turtles will be minimized by developing a vegetation trimming plan that minimizes the amount of vegetation that is removed from riparian areas.[7] The trimming plan will be developed by the golf course staff and reviewed by the Conservation Program Manager.
- To further reduce human impacts on the creeks, riparian areas will be "out of play" and players will not be allowed to enter the creek channel (below the top of the bank) to retrieve lost balls or continue play.
- Any changes in golf course management or maintenance techniques that would have an effect on Covered Species will be reviewed by the Conservation Program Manager prior to implementation.
- Golf course modifications will be reviewed by the Conservation Program Manager. Modifications made to existing portions of the golf course are not an expansion of the golf course, provided such modification does not exceed the existing footprint.
- The ball collector on the golf course driving range will not be used on rainy nights during the California tiger salamander migration period (November to April).
- New plantings of non-native ornamental species (other than maintenance of the existing turf and landscaped areas) will not be permitted within 75 feet of the top of any creek bank, unless approved by the Conservation Program Manager.
- The addition of native plants along the riparian zone will be strongly encouraged.
- Impacts from biocides and fertilizers have been substantially reduced over the past 5 years, and Stanford will continue to minimize potential impacts from these substances by using spot treatment for pests where required and using slow-release fertilizers.
- New plantings at the golf course will not include species listed on the California Invasive Plant Council list then in effect.
- Feral cat feeding stations will not be allowed.
- A California tiger salamander education program will be developed by the Conservation Program Manager and presented annually to maintenance workers and staff at the golf course and driving range. The education program will include protocols for identification, avoidance, immediate protection, and notification of the Conservation Program Manager. The Conservation Program Manager will have the authority to stop work if a Covered Species is encountered and may relocate the individual to a safer location within Zones 1 or 2.

Recreational Activities. To avoid and minimize the impacts from recreational activities, Stanford will implement the following measures.

Recreational Activities Measures

- Recreational activities that the Conservation Program Manager determines are detrimental to the Covered Species will be restricted or eliminated.
- Recreational areas in Zones 1 and 2 may be used during the daytime only.
- Recreational activities will be limited to developed routes. Enforcement of this limitation will be provided through additions of appropriate signs and fencing, and continued or expanded patrol by Stanford's public safety personnel.
- Unauthorized trails will be reclaimed.
- No dogs will be allowed on recreational trails or routes in Zones 1 and 2 south of Junipero Serra Boulevard, except as allowed by public easement or local law or regulation.

[7] The vegetation provides shade, which is important to many salmonids, including steelhead.

- No vehicles, except service vehicles (University, lessees, and utility companies) and emergency vehicles, will be allowed.
- No access to the creek channels will be allowed except for access by authorized Stanford or emergency personnel.
- New recreational routes[8], including any trails, pathways, or roads, must be reviewed by the Conservation Program Manager. New recreational routes will avoid Zones 1 and 2 to the greatest extent feasible. If any are proposed, they may not be sited through, or within 150 feet of, any creek bank, except to cross bridges.
- No lights or vegetation trimming associated with recreational routes will be allowed in Zone 1 (except trimming activities associated with the golf course done in accordance with the *Golf Course Measures* or trimming associated with trails).
- No recreational hunting or fishing will be allowed.
- California tiger salamander and garter snake education programs will be developed by the Conservation Program Manager and presented annually to maintenance workers and staff at the Equestrian Center. The education program will include protocols for identification, avoidance, immediate protection, and notification of the Conservation Program Manager. The Conservation Program Manager will have the authority to stop work if a Covered Species is encountered and may relocate the individual to a safer location within Zones 1 or 2.
- The realignment of any recreational route will be reviewed by the Conservation Program Manager, and if the realignment would adversely affect the Covered Species, the realignment may be approved only if it is required for public safety purposes or otherwise legally required. Such realignments will require mitigation unless the Conservation Program Manager determines the new recreational route alignment, with restoration of the old route, would serve as habitat enhancement.

4.2.7 Grounds and Vegetation

Fire Control and Public Safety. To avoid and minimize the impacts from fire control and public safety activities, Stanford will implement the following measures. These measures do not apply to an unplanned fire or other public safety emergency, in which case, emergency personnel may use any methods that are deemed necessary to control and extinguish the fire, and protect human life and property.

[8] New recreational routes do not include any routes that have been approved by Santa Clara or San Mateo County, including the portions of the C-1 and S-1 trails on Stanford land, before the approval of the HCP.

Fire Control and Public Safety Measures

- Firebreaks in Zone 1 will be limited to 10- to 15-foot-wide mown, not disced, strips, unless required by a regulatory authority for safety purposes. If a regulatory authority demands a wider firebreak in Zone 1, Stanford and the Service will confer to determine if mitigation for permanent loss of habitat is required.
- Mowing/discing in Zone 1 will be conducted either in the morning when it is still cool or during the hottest part of the day.
- Discing, if used, will be done with a shallow blade that is approximately 4-6 inches deep.
- Mowing or weed whacking will be done to a height of no less than 4 inches.
- New firebreaks must be reviewed by the Conservation Program Manager.
- Restoration efforts following a fire or other public safety emergency will be done under the supervision of the Conservation Program Manager.

Grounds Maintenance. Grounds maintenance activities that are not already covered by a more specific measure (such as those under the *General Infrastructure Measures* in Section 4.2.5), will be subject to the following measures.

Grounds Maintenance Measures

- The Conservation Program Manager will be notified before maintenance of existing landscaping located within Zone 1 is conducted.
- No new landscaping within Zones 1 and 2 will be allowed unless it benefits the Covered Species (e.g., to control invasive plant species) or is required for safety reasons.
- The Conservation Program Manager will be notified if any temporary stockpiling or staging area is required in Zone 1 and it will not be allowed unless associated with existing structures in that zone.
- If feasible, stockpiled materials will be covered in a manner that prevents Covered Species from entering them. The Conservation Program Manager or other qualified biologist will visually survey all stockpiled materials before moving them.
- Stockpiling materials for longer than 1 year constitutes a permanent loss of habitat.
- All ground animal control programs will be discontinued in Zone 1 areas of the California Tiger Salamander Basin, except for formal landscaped

or turf areas, or where animal control is necessary for public safety (e.g., squirrel control in the Lagunita berm that is necessary to maintain the dam).

- Vegetation management activities in Zone 1 areas of the California Tiger Salamander Basin will be restricted to mowing or weed whacking to a height of no less than 4 inches. The mowing or weed whacking will take place when the soil is the firmest, and never earlier than 5 days after a rain event. Mowing will be done by the lightest vehicle capable of mowing the area. Discing will be permanently discontinued in Zone 1 areas of the California Tiger Salamander Basin except where it is necessary for increased fire protection or in areas where it is not feasible to mow.

4.2.8 Agricultural and Equestrian Leaseholds

Stanford developed Best Management Practices (BMPs) for its equestrian and agricultural lessees to use for managing animal waste, compost, and sediment in creeks (Appendix B). In addition, Stanford includes requirements in its leases to prevent overgrazing. To further avoid and minimize the impacts from equestrian and agricultural activities to Covered Species, Stanford will implement the following measures.

Agricultural and Equestrian Lessee Measures

- New and renewed leases will include provisions that require lessees that engage in an activity that affects a Covered Species, as determined by the Conservation Program Manager, to update their Best Management Practices (BMPs) every 2 years. The BMPs will be reviewed and approved by the Conservation Program Manager.
- Lessees will be monitored semi-annually by Stanford for compliance with their BMPs. Lessees will be required to address identified problems within a reasonable period of time.
- Structures, crop fields, stables, equestrian creek crossings, and paddocks will be moved out of Zone 1 wherever moving such facilities is feasible.
- No new structures will be allowed in Zone 1.
- The *Recreational Activities Measures* that are applicable to equestrian uses (e.g., use of developed recreational routes) will apply to all equestrian lessees.

4.2.9 Commercial and Institutional Leaseholds

To avoid and minimize the impacts from current and future independent research institutional lessees activities, Stanford will implement the following measures. In addition, SLAC maintenance and the Independent Research Institutional Lessee activities will be subject to the Existing Utility Measures, New Utility Measures, *General Infrastructure Measures*, and *Grounds Maintenance Measures*.

SLAC and Independent Research Institutional Lessee Measures

- No new landscaping within Zones 1 and 2 will be allowed unless it benefits the Covered Species (e.g., to control invasive plant species), is required for safety reasons, or is mitigated as loss of habitat.
- Feral cat feeding stations will not be allowed.
- All ground animal control programs will be discontinued, unless they are required for safety reasons (e.g., within 10 feet of buildings).
- California tiger salamander and garter snake education programs will be developed by the Conservation Program Manager and presented annually to maintenance workers and staff. The education program will include protocols for identification, avoidance, immediate protection, and notification of the Conservation Program Manager. The Conservation Program Manager will have the authority to stop work if a Covered Species is encountered and may relocate the individual to a safer location within Zones 1 or 2.

Commercial Leases Measure

- If a Covered Species is found during maintenance of commercial leases in Zones 3 or 4, the Conservation Program Manager will be notified. The Conservation Program Manager will have the authority to stop work if a Covered Species is encountered and may relocate the individual to a safer location within Zones 1 or 2.

4.2.10 Future Development

To avoid and minimize the impacts from future development, Stanford will implement the following measures. These measures apply to the development covered by the GUP, and to any other future development beyond the GUP (Table 4-1).

General Future Development Measures

- Future development will occur predominately in Zones 3 and 4.
- If development occurs in Zones 1 or 2, the appropriate surveys for Covered Species will be conducted prior to final site approval.
- For any development in Zones 1, 2, and 3, and areas of Zone 4 that are within 100 yards of Zone 1, pre-construction surveys for the Covered Species will be conducted in accordance with then-current Service protocols, and any located individuals will be salvaged and relocated to appropriate habitat.
- An on-site biological monitor will be present during all ground-disturbing activity in Zones 1 and 2. The biological monitor will have the authority to stop work if a Covered Species is encountered and may relocate the individual to a safer location within Zones 1 or 2.
- Any development in Zone 1 of the California Tiger Salamander Basin will be reviewed by the Conservation Program Manager to ensure that: New curbs will encourage migration where desirable, or discourage migration into hazardous areas; adverse lighting conditions are minimized; there are adequate garbage facilities; there will be a minimization of ground squirrel control (through, for example, the use of landscaping that does not require pesticides or fertilizers) except as required for public safety; and utility boxes will have as few openings to the surface as possible.
- Construction vehicles in Zones 1 and 2 will be limited to 10 mph, and any fuels stored during construction will be double-contained.
- Any excess asphalt used during construction will be removed upon the completion of construction.
- If a Covered Species is found during construction in Zones 3 and 4, the Conservation Program Manager or another biologist qualified by the Service will relocate the Covered Species to more suitable habitat in Zone 1 or 2.
- For any development in Zones 1, 2, and 3, and areas of Zone 4 that are within 100 yards of Zone 1, open pits, trenches, and excavated areas will be backfilled as soon as possible, and will be secured at the end of every work day in a manner that prevents Covered Species from entering them.
- For any development in Zones 1, 2, and 3, and areas of Zone 4 that are within 100 yards of Zone 1, the construction site will be secured with a solid barrier (e.g., silt fence, plywood, etc.) a minimum of 3 feet tall at the perimeter of the site, buried at least 4 inches into the ground. If the solid barrier coincides with a cyclone fence, the solid barrier will be attached to the outside of the cyclone fence. The barrier will be inspected by an appropriately trained person once a week, and repairs / replacement will be made as necessary

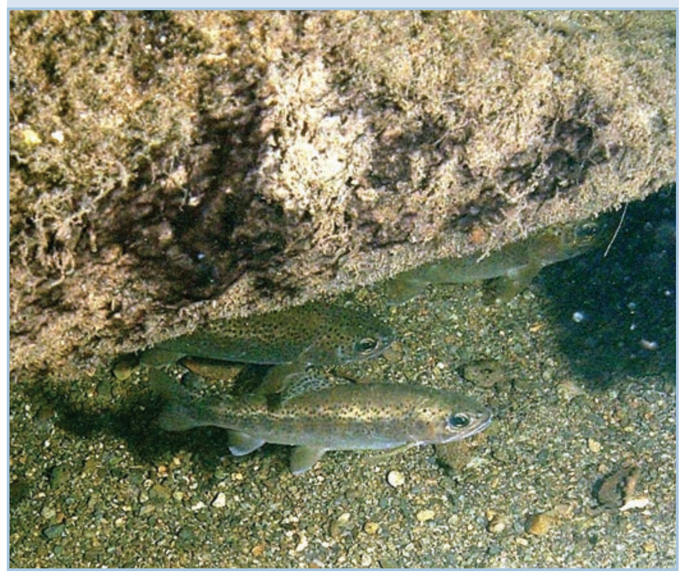


Table 4-1 Anticipated Loss of Habitat from Future Development

	Zone 1 (acres)	Zone 2 (acres)	Zone 3 (acres)	Total (acres)
Development under GUP	15	15	0	30
Development beyond GUP	5-15	10-30	35-105	50-150
Total Development	20-30	25-45	35-105	80-180
Total acres in Habitat Zone	1,295	1,260	2,446	5,001
Percent Developed	2%	2-4%	1-4%	2-4%

4.3 ESTABLISHMENT OF MITIGATION ACCOUNTS

Stanford will implement a "mitigation account system" that will (1) establish mitigation lands (and associated mitigation credits) at the outset of HCP implementation; and (2) continuously track the utilization of such mitigation credits over time.

To address impacts to Covered Species in riparian zones, Stanford will create two "Riparian Accounts": the San Francisquito/Los Trancos Riparian Account; and the Matadero/Deer Riparian Account. Each of these Riparian Accounts will be funded at the outset of HCP implementation by recording permanent conservation easements over large areas of red-legged frog, western pond turtle, garter snake, and steelhead habitat. These lands will be managed in accordance with habitat Monitoring and Management Plans that are described in more detail in Sections 4.3.1.2 and 4.3.2.2. Each acre of preserved habitat will constitute 1 credit for mitigation accounting purposes.

To address impacts to California tiger salamanders and garter snakes, Stanford will create a CTS Account. At the outset of HCP implementation, Stanford will establish a large CTS Reserve, and will manage that Reserve in accordance with a habitat Monitoring and Management Plan, as described in Section 4.3.3.2. Stanford will not earn any mitigation credits for these Reserve lands at the outset of the HCP, but will earn credits later when it permanently preserves Reserve lands through recordation of conservation easements. In addition, Stanford will manage an area of the central campus for the benefit of the California tiger salamander and garter snake, as described in Section 4.3.3.4.

During the life of the HCP, Stanford can earn additional credits that will be held in the Riparian Accounts by permanently preserving additional habitat and by enhancing and/or creating additional habitat. Likewise, Stanford will earn credits by permanently conserving habitat in the CTS Reserve, and these credits will be held in the CTS Account. Specifically, Stanford will earn 1 credit for each additional acre of riparian habitat or upland California tiger salamander/garter snake habitat that it permanently preserves, and 25 credits for each acre of permanently preserved tiger salamander breeding habitat. "Breeding habitat," for purposes of earning mitigation credits, is defined as a pond that supports successful California tiger salamander reproduction 3 years within a 6-year period (excluding years of below average rainfall)[9] and includes metamorph dispersal habitat within 50 feet of the pond.

Stanford may increase the amount of credits in the Accounts by enhancing habitat and using the credits at a later date. In this manner, Stanford can take advantage of habitat enhancement opportunities when they arise, and be assured that its efforts to promote the Covered Species may be used to offset later potential habitat losses. The Enhancement Options described in Table 4-2 allow Stanford to earn credits for performing habitat enhancements that are likely to benefit the Covered Species.

Table 4-2 is not an exhaustive list of possible enhancements. If other enhancements are identified during the life of the HCP, Stanford will earn credits for those enhancements that are consistent with the allocation of credits presented in Table 4-2. The number of credits that Stanford will earn for enhancing existing and potential habitat varies depending upon the benefit to the Covered Species, cost, and difficulty in implementing the enhancement.

Prior to performing any restoration or enhancements, Stanford will prepare a plan that describes the proposed enhancement and/or restoration, minimum and long-term success criteria, monitoring plan, and number of credits to be awarded. The plan will describe when and under what circumstances credits will be awarded; and, in general, credits or partial credits will be awarded when the minimum success criteria are achieved. This plan will be approved by the Service and/or NOAA Fisheries, depending on the Covered Species benefitted by the restoration or enhancements.

The credits earned through additional permanent preservation and habitat enhancements will be credited towards the Riparian Accounts depending upon the location of the habitat that is preserved or enhanced. Enhancements and preservation within the San Francisquito/Los Trancos Creek Basin will be credited to the San Francisquito/Los Trancos Riparian Account and enhancements and preservation within the Matadero/Deer Creek Basin will be credited to the Matadero/Deer Riparian Account. The boundaries of the Basins are shown on Figures 4-3 and 4-4.

Permanent land preservation within the CTS Reserve will be credited towards the CTS Account. Stanford may enhance tiger salamander habitat at any time, and has already constructed eight new potential breeding ponds. During the period 2005-2010, Stanford experienced average or above average seasonal rainfall during 5 of those 6 years. In that time California tiger salamanders bred successfully four times in Pond #1, twice in Pond #5, and once in Pond #2 (Figure 2-4). Pond #1 therefore meets the definition of "breeding habitat." However, no credits will be awarded for these enhancements until a permanent conservation easement is recorded over the habitat. The boundary of the CTS Reserve is shown on Figure 4-5.

As described in Section 4.4, Stanford will withdraw credits from the Accounts whenever it permanently converts any land within Zones 1, 2, or 3. Permanent conversion will generally result from future development, but also may occur from other activities, such as landscaping or the construction of

[9] With the approval of the Service, Stanford may exclude years with average or above average rainfall from this calculation if rainfall patterns resulted in a situation where successful reproduction would not be expected to occur.

Table 4-2 Preservation or Enhancement Activities

Preservation or Enhancement	Credits Earned	Account Credited
Record conservation easement over additional habitat within the Matadero/Deer Creek Basin	1 credit for each acre of habitat.	Matadero/Deer Riparian Account
Record conservation easement over additional habitat within the San Francisquito/Los Trancos Creek Basin	1 credit for each acre of habitat.	San Francisquito/Los Trancos Riparian Account
Record conservation easement over habitat within the CTS Reserve	1 credit for each acre of upland habitat. 25 credits for each acre of breeding habitat	CTS Account
Improve steelhead habitat by increasing the minimum bypass flow rates in Los Trancos Creek (above SHEP standards) by permanent changes to diversion operations	5-50 credits per cfs increase depending on the benefits (e.g., higher credit amount for increasing bypass after the attraction flow)	San Francisquito/Los Trancos Riparian Account
Improve steelhead habitat by increasing the minimum bypass flow rates in San Francisquito Creek (above SHEP standards) by permanent changes to diversion operations	5-50 credits per cfs increase depending on the benefits (e.g., higher credit amount for increasing bypass after the attraction flow)	San Francisquito/Los Trancos Riparian Account
Expand riparian areas around the creeks by removing existing structures and planting riparian vegetation	3 credits for each restored acre	San Francisquito/Los Trancos Riparian Account if enhancement is to Los Trancos, San Francisquito, Corte Madera, Sausal or Bear creeks Matadero/Deer Riparian Account if enhancement is to Matadero or Deer creeks
Remove partial in-stream barriers that have a net adverse affect on steelhead, such as preventing dispersal, outside of Stanford lands	5 credits for removals downstream of Stanford and 1 credit for upstream removals	San Francisquito/Los Trancos Riparian Account if enhancement is to Los Trancos, San Francisquito, Corte Madera, Sausal or Bear creeks Matadero/Deer Riparian Account if enhancement is to Matadero or Deer creeks
Repair and stabilize the creek banks using bio-engineered stabilization[9] methods to pro-actively remediate erosion and bank stabilization problems that are not associated with a new project or is not conducted to protect existing Stanford infrastructure	1 credit per 200 feet of fixed bank	San Francisquito/Los Trancos Riparian Account if enhancement is to Los Trancos, San Francisquito, Corte Madera, Sausal or Bear creeks Matadero/Deer Riparian Account if enhancement is to Matadero or Deer creeks
Restore the natural geomorphology of stream channels through replacement of existing hardscape with bio-engineered stabilization methods	1 credit per 200 feet of fixed bank	San Francisquito/Los Trancos Riparian Account if enhancement is to Los Trancos, San Francisquito, Corte Madera, Sausal or Bear creeks Matadero/Deer Riparian Account if enhancement is to Matadero or Deer creeks
Construct additional water quality monitoring stations along creek(s) and operate for 5 years[10]	1 credit for each additional station	San Francisquito/Los Trancos Riparian Account if enhancement is to Los Trancos, San Francisquito, Corte Madera, Sausal or Bear creek Matadero/Deer Riparian Account if enhancement is to Matadero or Deer creeks
Create new off-channel California red-legged frog breeding ponds	25 credits for each pond (15 credits will accrue when the agreed short-term success criteria are met and an additional 10 credits will accrue when long-term success criteria are met)	San Francisquito/Los Trancos Riparian Account if enhancement if pond is created within the San Francisquito/Los Trancos Creek Easement Matadero/Deer Riparian Account if pond is created within the Matadero/Deer Creek Easement

[8] Bioengineering techniques emphasize the use of natural and local building materials, e.g. stone, gravel, sand, soil, wood, branched logs, and native plants. Typical bioengineering practices include: brushlayering, brush mattresses, brush walls/bundles, hand seeding or hydro-seeding, incorporation of large woody debris, and live staking. Rip-rap, rock, and other hardscape materials will only be used where required (e.g., areas of high scour).
[9] This enhancement includes the construction and operation of water quality monitoring stations in reaches of the creeks that are outside of Stanford's lands.

new roads. The Account from which Stanford will withdraw the credits depends upon the location of the converted land, and the amount of the withdrawal depends upon the Zone in which the converted land is located. For example, Stanford would withdraw credits from the CTS Account if a new project adversely affects any Zone 1, 2, or 3 habitat in the California Tiger Salamander Basin, which is shown on Figure 4-5. Alternatively, new development in Zone 1, 2 or 3 within the Matadero/Deer Creek Basin (Figure 4-4) would require Stanford to withdraw credits from the Matadero/Deer Riparian Account, and any development in Zone 1, 2 or 3 within the San Francisquito/Los Trancos Creek Basin (Figure 4-3) would require Stanford to withdraw credits from the San Francisquito/Los Trancos Riparian Account.

4.3.1 San Francisquito/Los Trancos Riparian Account

4.3.1.1 San Francisquito/Los Trancos Easement

Within 1 year of approval of this HCP and issuance of the Section 10(a) authorizations, Stanford will fund the San Francisquito/Los Trancos Riparian Account by recording a permanent conservation easement over approximately 270 acres of the most biologically sensitive portions of San Francisquito, Bear, and Los Trancos creeks and adjacent riparian lands.[10] The easement area is shown on Figure 4-3. The 270-acre Los Trancos/San Francisquito Easement will cover portions of Zone 1, and include the creek banks and the creek channels. It also includes riparian woodlands and some annual grassland and oak woodlands and some degraded areas that are adjacent to existing urban land uses. The width of the easement varies from 70 to 400 feet depending upon whether Stanford owns both sides of the creek and the presence of existing improvements. These 270 acres will be actively managed in perpetuity for the benefit of the California red-legged frog, western pond turtle, garter snake, and steelhead in accordance with the San Francisquito/Los Trancos Monitoring and Management Plan discussed below. Preserving and actively managing these areas will foster important habitat linkages, and improve the existing habitat, particularly in areas that have become degraded.

The approximate boundary of the entire 270-acre San Francisquito/Los Trancos easement area is shown on Figure 4-3. Due to existing lease agreements, Stanford does not have exclusive control over approximately 10-15 acres that are shown within the 270-acre San Francisquito/Los Trancos easement area. The areas that are subject to existing lease agreements may not be subject to the initial easement that Stanford will record within the first year of the HCP's approval, but will be phased into the easement area as the existing agreements expire.

4.3.1.2 San Francisquito/Los Trancos Easement Monitoring and Management Plan

Stanford will implement the following management and monitoring measures.

- Surveys for steelhead, red-legged frogs, garter snakes, and western pond turtles, and of their habitat, will be conducted in accordance with the monitoring program set forth in Section 4.6 for the term of this HCP.
- If the monitoring program results show the presence of non-native animal species that could adversely affect Covered Species within the Easement area, the non-natives will be removed, to the extent that Stanford can feasibly remove or control them. Before trapping is used to remove the non-natives in areas where any Covered Species may occur, Stanford will submit a plan to the Service and NOAA Fisheries for approval.
- If the monitoring program results show that non-native plant species could adversely affect Covered Species or their habitat within the Easement area, the non-natives will be removed, to the extent that Stanford can feasibly remove or control them.
- If the surveys determine that wildlife species have been placed within the Easement area, Stanford will post signs prohibiting the release of any wildlife species in the ponds and/or fence as necessary.
- If the steelhead habitat or gravel surveys identify sediment entering the creek from a point source, Stanford will try to identify the source of the sediment. If the sediment source is located on Stanford lands, Stanford will notify NOAA Fisheries and the Service and will remediate the situation. If the sediment source is located off Stanford lands, Stanford will notify NOAA Fisheries and the Service.
- If the steelhead surveys or other information find that the steelhead would benefit from a habitat enhancement such as the addition of woody debris and it can be done without increasing the potential for flooding, Stanford will place large woody debris into the creeks, anchored in place.
- If the creek surveys find that the turtles would benefit from the addition of natural basking platforms, Stanford will place anchored platforms, if it can be done without increasing the potential for flooding.
- If turtle habitat surveys find that the turtles would benefit from the addition of natural or artificial basking platforms, Stanford will place three anchored platforms each in Searsville Reservoir, Felt Reservoir, and Skippers Pond.

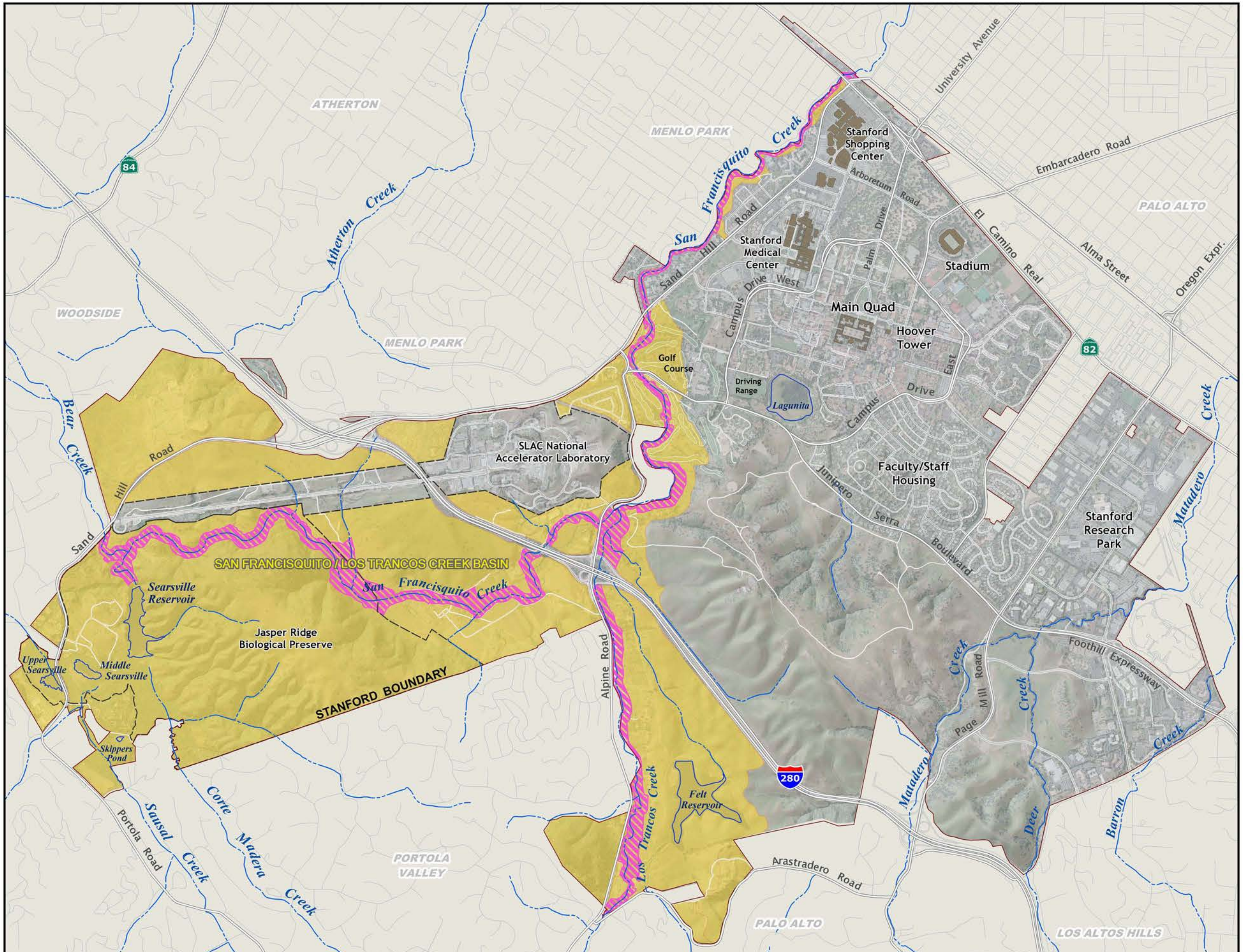
[10] All conservation easements created pursuant to the HCP will comply with the California Civil Code, which permits the creation of a conservation easement through a deed restriction or other instrument that is perpetual in nature. Cal. Civ. Code §815.1. The conservation easements recorded as part of the HCP's Conservation Program will be consistent with the terms of the HCP. As such, the conservation easements will allow Stanford to engage in certain activities (such as ingress and egress through the easement areas for routine creek maintenance) that are permitted by the HCP.

Stanford University Habitat Conservation Plan

San Francisquito/ Los Trancos Creek Basin

San Francisquito / Los Trancos Creek Easement

Mitigation Basin



hectare

100

25

4

acres

Sources:
Reserves: Stanford University Campus Biologist, 2006
Aerial photos: Aerotopia, 1999
Creeks: US Geological Survey, 1991

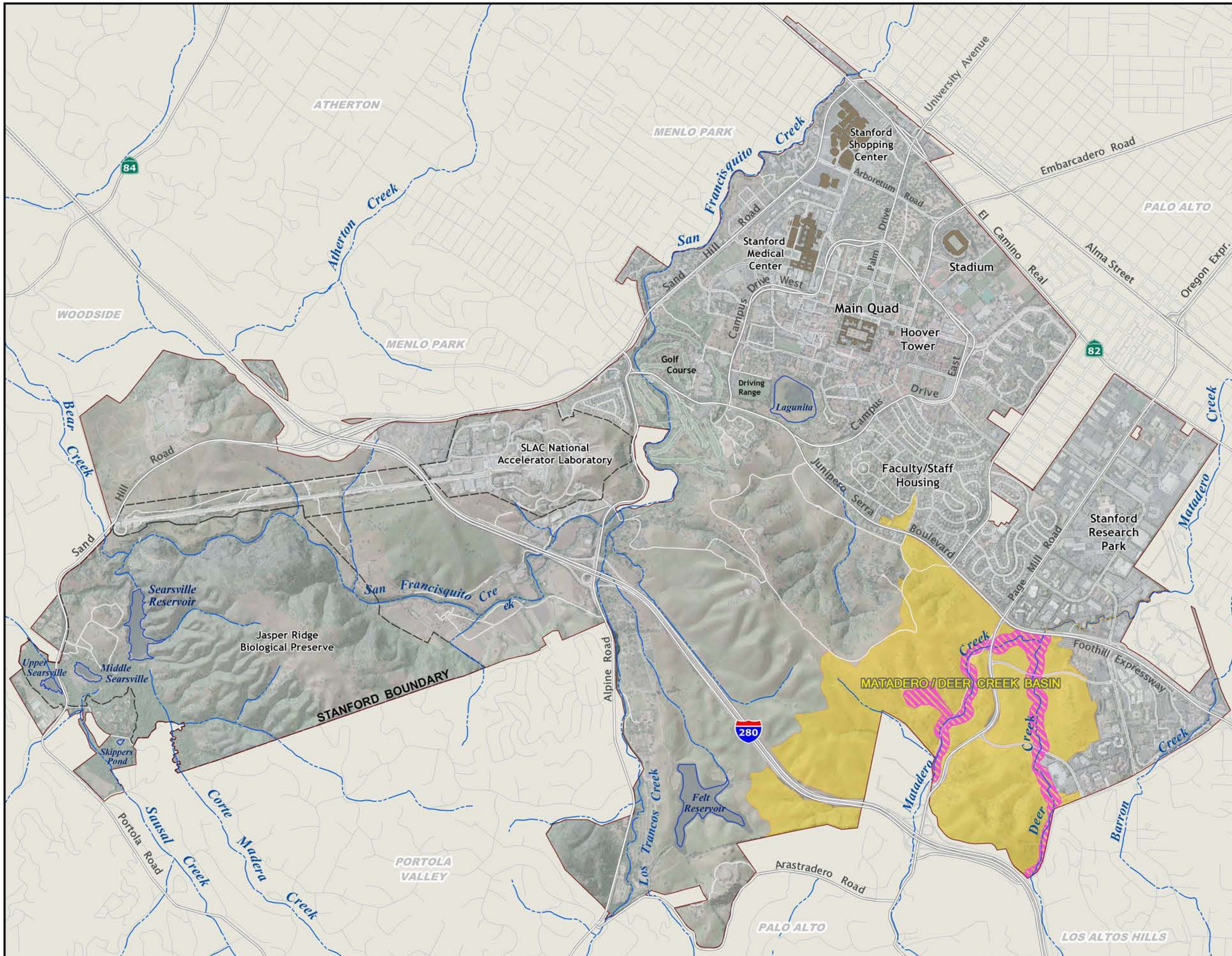
Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 4-3



Stanford University Habitat Conservation Plan

Matadero / Deer Creek Basin

Matadero/Deer Creek Easement

Mitigation Basin

hectare

100

25

4

acres

Sources:
Reserves: Stanford University Campus Biologist, 2006
Aerial photos: Aerotopia, 1999
Creeks: US Geological Survey, 1991

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Graphic Scale
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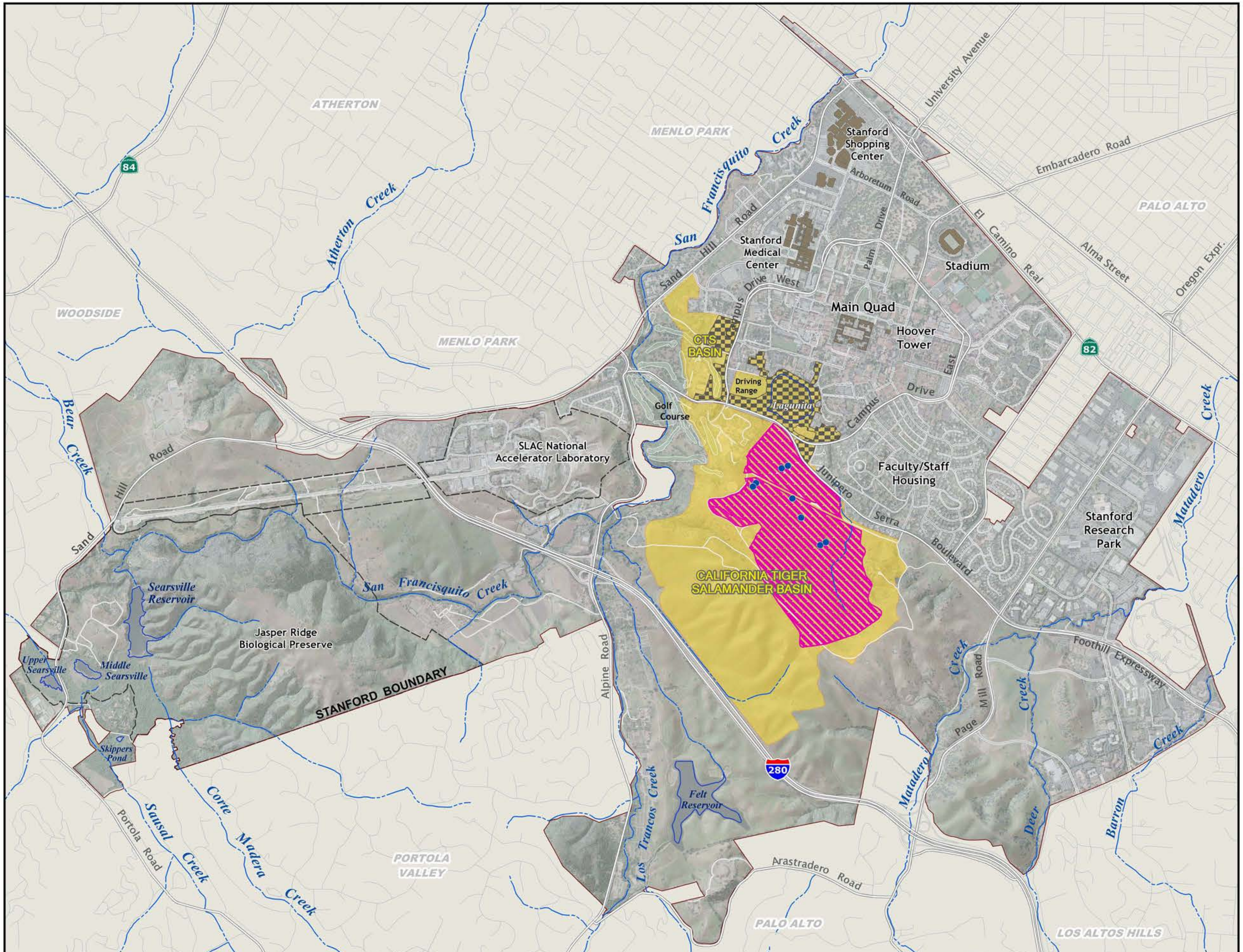
0 0.25 0.5 0.75 1

Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 4-4



Stanford University Habitat Conservation Plan

CTS Basin

California Tiger Salamander (CTS) Reserve

Central Campus CTS Management Area

Mitigation Basin

Recently Established Pond

hectare
100
25
4
acres

Sources:
Reserves: Stanford University Campus Biologist, 2006
Aerial photos: Aerotopia, 1999
Creeks: US Geological Survey, 1991

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Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

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Figure 4-5

- In addition to providing annual results of the monitoring program to the Service and NOAA Fisheries, Stanford will share the monitoring results with other interested local, state and federal conservation agencies.
- Stanford will maintain the three existing water quality monitoring stations located in Los Trancos, Bear, and San Francisquito creeks for the first 5 years of the HCP and the resulting data will be reviewed for their value in conservation efforts. If the stations produce data that are useful to conservation planning, operation of the monitoring stations will continue beyond 5 years.
- If water quality monitoring data are found to be valuable in conservation efforts, Stanford will perform a study on the feasibility of expanding the network of water monitoring stations in San Francisquito Creek and Los Trancos Creek. If it is feasible, Stanford will expand the network of water monitoring stations.
- Stanford will ensure that one stream flow gaging station on San Francisquito Creek and one on Los Trancos Creek are operational year-round, and that the daily flow data are made available to NOAA Fisheries.
- Stanford will evaluate the creek corridor and identify at least two areas where two new off-channel California red-legged frog breeding ponds may be constructed. Stanford will provide the Service with a proposal to construct new seasonal ponds in these areas. The proposal will include the location, size, shape, and depth of the new ponds, short-term success criteria for the ponds (e.g., minimum ponding time and depth and vegetation cover), and long-term success criteria monitoring plan for the ponds. The long-term monitoring will be consistent with the California red-legged frog monitoring protocols outlined in Section 4.6.
- Stanford will remove undesirable items, such as trash, from the creeks.
- Stanford will initiate stabilization efforts along stream banks and adjacent upland areas that are subject to erosion (use of biological stabilization methods will be strongly encouraged), and create a pilot program for streambank protection that could be used as a community resource.
- Stanford will initiate revegetation efforts along stream banks and adjacent upland areas that are subject to erosion.
- If the annual stream surveys or other information find that structures such as rip-rap, gabions, and in-stream structures are impeding fish passage, Stanford will remove these structures, when feasible. Within 3 years of NOAA Fisheries' approval of the HCP and issuance of an incidental take permit, Stanford will assess the extent that fish passage is impeded by an existing concrete road crossing on San Francisquito Creek immediately downstream of the confluence with Bear Creek and evaluate the feasibility of improving fish passage at this location.[11]

- Stanford will implement the operational protocols for water diversion on Los Trancos Creek and at the San Francisquito Creek pumping station contained in the SHEP for the life of the HCP.
- Stanford will erect fences in the areas that the Conservation Program Manager determines they are needed to keep livestock and unauthorized persons out of the Easement.
- Feral cat feeding stations will not be allowed in the Easement area, or within 150 feet of the Easement.
- No new permanent structures may be erected on lands covered by the San Francisquito/Los Trancos Easement unless the structures are for the benefit of the Covered Species, are necessary for safety reasons, or are part of Stanford's existing water diversion system. This prohibition does not preclude maintenance and improvement of existing structures, including utilities, roads, and buildings. Structures used to study the geomorphological, hydrological, and biological characteristics of the creeks and surrounding uplands will be allowed if they provide information that contributes to the management of the Covered Species. New bridges are not precluded by the San Francisquito/Los Trancos Easement, but will require mitigation in accordance with Section 4.4 if the new bridge results in the permanent loss of habitat. In addition, an enhancement to increase steelhead habitat diversity and complexity (e.g., logs, root wads, and boulders) commensurate with the loss of habitat from the new bridge will be constructed. The Conservation Program Manager will be consulted before any permanent structures are erected, and such structures will be designed to minimize or avoid impacts to the Covered Species.
- Any new conservation easements within the San Francisquito/Los Trancos Creek Basin will be subject to the San Francisquito/Los Trancos Easement Monitoring and Management Plan. Stanford will consult with the Service and NOAA Fisheries before recording any new conservation easements within the San Francisquito/Los Trancos Creek Basin.

[11] This evaluation will not preclude Stanford from monitoring for other possible barriers to fish passage or removing/ minimizing other fish passage impediments during the first 3 years of the HCP's implementation.

- Five years before the expiration of the HCP and associated incidental take permits, Stanford will prepare a long-term monitoring and management plan that incorporates management and monitoring techniques that have been demonstrated to be the most successful. The long-term monitoring and management plan will include protocols for monitoring the abundance of Covered Species in the Easement area and the quality of preserved habitat, invasive species monitoring and management, an adaptive management provision, and any other monitoring or management techniques that Stanford deems necessary to fulfill the conservation purpose of the San Francisquito/Los Trancos Conservation Easement. This monitoring and management plan will survive the expiration of the incidental take permits and this HCP, and will be subject to review and approval by the Service and NOAA Fisheries.

4.3.1.3 San Francisquito/Los Trancos Riparian Account Credits

Stanford will earn 270 credits for recording the San Francisquito/Los Trancos Easement and implementing the San Francisquito/Los Trancos Easement Monitoring and Management Plan. These credits will be withdrawn from the San Francisquito/Los Trancos Riparian Account to mitigate for future development projects or other permanent land conversions. The number of credits that Stanford will earn for preserving additional land or performing habitat enhancements will be calculated in accordance with Table 4-2.

4.3.2 Matadero/Deer Riparian Account

4.3.2.1 Matadero/Deer Easement

Within 1 year of approval of this HCP and issuance of the Section 10(a) authorizations, Stanford will fund the Matadero/Deer Riparian Account by recording a permanent conservation easement over 90 acres of the most biologically sensitive portions of Matadero and Deer creeks and adjacent riparian lands. The easement area is shown on Figure 4-4. The 90-acre Matadero/Deer Easement will cover Zone 1 lands, and includes the riparian zone, which is all of the undeveloped land within 150 feet of the top of the creek bank, the creek channels, and a portion of small tributary of Matadero Creek that originates in an abandoned quarry. Part of the Matadero/Deer Easement is covered by annual grassland, oak woodland, and rock outcrops.

The Matadero Creek watershed, which includes Deer Creek, is relatively small, approximately 7.25 square miles. Matadero and Deer creeks are part of a single watershed, and display similar characteristics, thus forming a convenient and consistent management unit. The Matadero/Deer Easement will be managed for the benefit of the California red-legged frog and garter snake in accordance with the Matadero/Deer Easement Monitoring and Management Plan described below.

4.3.2.2 Matadero/Deer Easement Monitoring and Management Plan

Stanford will implement the following management and monitoring measures.

- Surveys for the red-legged frog and garter snake and of their habitat will be conducted in accordance with the monitoring plan set forth in Section 4.6 for the term of this HCP.
- If the monitoring program results show the presence of non-native animal species that could adversely affect Covered Species within the Easement area, the non-natives will be removed, to the extent that Stanford can feasibly remove or control them. Before trapping is used to remove the non-natives in areas where any Covered Species may occur, Stanford will submit a plan to the Service for approval.
- If the monitoring program results show that non-native plant species could adversely affect Covered Species or their habitat within the Easement area, the non-natives will be removed, to the extent that Stanford can feasibly remove or control them.
- If the surveys determine that wildlife species have been placed within the Easement area, Stanford will post signs prohibiting the release of any wildlife species in the ponds and/or fence as necessary.
- In addition to providing annual results of the monitoring program to the Service and NOAA Fisheries, Stanford will share the monitoring results with other interested local, state and federal conservation agencies.
- Stanford will evaluate the creek corridor and identify at least one area where two new off-channel California red-legged frog breeding ponds may be constructed. Stanford will provide the Service with a proposal to construct new seasonal ponds in these areas. The proposal will include the location, size, shape, and depth of the new ponds, short-term success criteria for the ponds (e.g., minimum ponding time and depth and vegetation cover), and a long-term monitoring plan for the ponds. The long-term monitoring will be consistent with the California red-legged frog monitoring protocols outlined in Section 4.6.
- Stanford will study the feasibility of installing water monitoring stations in Matadero and Deer creeks, and if it is feasible, Stanford will install water monitoring stations in the creek(s).
- Stanford will initiate revegetation efforts along stream banks and adjacent upland areas that are subject to erosion.
- Stanford will erect fences in the areas where the Conservation Program Manager determines they

are needed to keep livestock and unauthorized persons out of the Easement.

- Stanford will initiate stabilization efforts along stream banks and adjacent upland areas that are subject to erosion (use of biological stabilization methods will be strongly encouraged), and create a pilot program for streambank protection that could be used as a community resource.
- Feral cat feeding stations will not be allowed in the Easement area, or within 150 feet of the Easement.
- No new permanent structures may be erected on lands covered by the Matadero/Deer Easement unless the structures are for the benefit of the Covered Species or they are necessary for safety reasons. This prohibition does not preclude maintenance and improvement of existing structures, including utilities, roads, and buildings. Structures used to study the geomorphological, hydrological, and biological characteristics of the creeks and surrounding uplands will be allowed if they provide information that contributes to the management of the Covered Species. New bridges are not precluded from the Matadero/Deer Easement, but will require additional mitigation in accordance with Section 4.4 if the new bridge results in the permanent loss of habitat. The Conservation Program Manager will be consulted before any permanent structures are erected, and such structures will be designed to minimize or avoid impacts to the Covered Species.
- Any new conservation easements within the Matadero/Deer Creek Basin will be subject to the Matadero/Deer Easement Monitoring and Management Plan. Stanford will consult with the Service before recording any new conservation easements within the Matadero/Deer Creek Basin.
- Five years before the expiration of the HCP and associated incidental take permits, Stanford will prepare a long-term monitoring and management plan that incorporates management and monitoring techniques that have been demonstrated to be the most successful. The long-term monitoring and management plan will include protocols for monitoring the abundance of Covered Species in the Easement area and the quality of preserved habitat, invasive species monitoring and management, an adaptive management provision, and any other monitoring or management techniques that Stanford deems necessary to fulfill the conservation purpose of the Matadero/Deer Conservation Easement. This monitoring and management plan will survive the expiration of the incidental take permits and this HCP, and will be subject to review and approval by the Service.

4.3.2.3 Matadero/Deer Riparian Account Credits

Stanford will earn 90 credits for recording the 90-acre Matadero/Deer Easement and implementing the Matadero/Deer Easement Monitoring and Management Plan. These credits will be withdrawn from the Matadero/Deer Riparian Account to mitigate for future development projects or other permanent land conversions. The number of credits that Stanford will earn for preserving additional land or performing habitat enhancements will be calculated in accordance with Table 4-2.

4.3.3 CTS Account

Stanford has developed a comprehensive program to manage existing California tiger salamander and garter snake habitat, improve and enhance California tiger salamander and garter snake habitat, and mitigate for future losses of habitat for these species within the California Tiger Salamander Basin. This program includes the creation of a CTS Reserve and an accompanying Monitoring and Management Plan that are described in Sections 4.3.3.1 and 4.3.3.2, and the implementation of a Central Campus CTS Management Plan that is described in Section 4.3.3.4.

4.3.3.1 CTS Reserve

Within 1 year of approval of this HCP and issuance of the Section 10(a) authorizations, Stanford will create a CTS Reserve south of Junipero Serra Boulevard and implement a CTS Reserve Monitoring and Management Plan. The CTS Reserve includes approximately 315 acres of currently occupied and potential tiger salamander and garter snake habitat (Figure 4-5). The CTS Reserve contains eight California tiger salamander breeding ponds that Stanford constructed during the preparation of this HCP. California tiger salamander reproduction has already been documented in three of those ponds, and California tiger salamanders that breed at Lagunita already migrate to this area. The ponds, presence of amphibian prey, and grasslands in the CTS Reserve also provide high quality garter snake habitat.

The creation of the CTS Reserve implements two of the Biological Goals of the HCP, which are to stabilize the local California tiger salamander population and increase its chance of long-term persistence at Stanford, and to maintain CTS ponds to promote CTS reproduction in the Foothills. By so doing, Stanford will reduce California tiger salamander reliance on Lagunita, which requires supplemental water and extensive maintenance to support tiger salamander reproduction. Likewise, the CTS Reserve and accompanying Monitoring and Management Plan will benefit the garter snakes and reduce their reliance on Lagunita, which because of its urban location, has many threats to the garter snake population.

The CTS Reserve will also provide a means for mitigating the permanent loss of Zone 1, 2, and 3 habitat within the California Tiger Salamander Basin as described in Section 4.3.3.3.

4.3.3.2 CTS Reserve Monitoring and Management Plan

Stanford will preserve and enhance the quality of potential and existing tiger salamander and garter snake habitat within the CTS Reserve by implementing a CTS Reserve Monitoring and Management Plan. This Monitoring and Management Plan will consist of the following monitoring and management measures.

- Surveys for California tiger salamander and garter snake and of their habitat will be conducted in accordance with the monitoring program set forth in Section 4.6 for the term of this HCP.
- If the monitoring program results show that non-native wildlife species are adversely affecting the Covered Species, such as through direct kill or alteration of the habitat to the extent that it reduces its suitability, the non-natives will be removed, as allowed by law and to the extent that Stanford can feasibly remove or control them. Before trapping is used to remove the non-natives in areas where any Covered Species may occur, Stanford will submit a plan to the Service for approval.
- If the monitoring program results show that non-native plant species could adversely affect Covered Species or their habitat within the Reserve area, the non-natives will be removed, to the extent that Stanford can feasibly remove or control them.
- If the monitoring program results show that wildlife species have been placed in ponds within the Reserve area, Stanford will post signs prohibiting the release of any wildlife species in the ponds and/or fence the ponds as necessary.
- If monitoring determines that non-native species remain a threat to Covered Species despite Stanford's efforts at removal for 3 years, Stanford will consult with the Service to determine an appropriate plan of action.

- In addition to providing annual results of the monitoring program to the Service and NOAA Fisheries, Stanford will share the monitoring results with other interested local, state and federal conservation agencies.
- If the California tiger salamander habitat surveys find that the seasonal ponds are not facilitating tiger salamander breeding, the pond(s) will be modified or eliminated. Modifications to the pond(s) may include expanding or reducing the size of the pond, making the pond deeper or shallower, or providing a temporary water source. Stanford will consult with the Service regarding any proposed pond modifications.
- If there are 3 consecutive years of inadequate rainfall to sustain adequate larval development, Stanford will consult with the Service regarding ways to provide supplemental water to the constructed breeding ponds.
- If surveys indicate that tiger salamanders would benefit from the addition of cover or egg-laying substrate in the created ponds, Stanford will place suitable material in the ponds.
- Stanford will enhance tiger salamander and garter snake dispersal by mowing or grazing up to 2 acres of grassland adjacent to each of the newly created California tiger salamander breeding ponds annually during the summer. Mowing will be done either in the morning when it is still cool or during the hottest part of the day.
- If the California tiger salamander surveys find that the tiger salamanders would benefit from additional burrows, Stanford will enhance upland habitat adjacent to the newly created breeding ponds by creating cover piles to attract ground squirrels. Cover piles will typically be made of natural materials such as logs and rocks placed in a pit and backfilled with soil to create a mound, similar to those already created around existing ponds. Pits are generally up to 60 square feet and up to 4 feet deep. The cover piles will be located within 150 feet of the newly created breeding ponds. New cover piles will be created during the dry season, between June and September.
- The presence of oak woodland and savannah grasslands within 150 feet of the newly created

breeding ponds will be maintained, and Stanford will minimize the presence of chaparral grasslands (through hand removal, mowing, grazing, or spot application of pesticides if necessary).

- Stanford will maintain at least three amphibian tunnels across Junipero Serra Boulevard. If the results of the annual monitoring program show the amphibian tunnels are facilitating migration across Junipero Serra Boulevard and that additional tunnels would benefit tiger salamander migration, Stanford may install additional amphibian tunnels. Stanford would identify an appropriate location for the additional amphibian tunnel(s) based on the results of the annual monitoring program, and, before installing any new amphibian tunnels, obtain the Service's concurrence regarding the location of the new tunnel(s).
- Recreational access will be limited to existing service roads and restricted to daylight hours.
- No dogs will be permitted in the CTS Reserve.
- The Conservation Program Manager will review any proposed academic uses within the CTS Reserve, and if necessary, impose use conditions and restoration measures.
- Development, such as academic buildings, residential dwelling units, or commercial buildings, will be prohibited. Utilities and other general infrastructure improvements that would not adversely affect the tiger salamander habitat may be placed within the CTS Reserve. However, these improvements will be reviewed by the Conservation Program Manager, and if necessary, the Conservation Program Manager may impose use conditions and restoration measures.
- A California tiger salamander and garter snake education program will be developed by the Conservation Program Manager and presented to Stanford maintenance personnel and contractor personnel working in, or immediately adjacent to, the CTS Reserve. The education program will include protocols for identification, avoidance, immediate protection, and notification of the Conservation Program Manager.
- Feral cat feeding stations will not be allowed in the CTS Basin south of Junipero Serra Boulevard. Any feral cat feeding stations found in these areas will be removed.
- All ground animal control programs will be discontinued in the CTS Reserve.
- Vegetation management activities in the CTS Reserve will be conducted to achieve the goal of improving CTS habitat.
- Prior to recording the first conservation easement within the CTS Reserve, Stanford will prepare a CTS Easement Monitoring and Management Plan that specifically describes (1) how Stanford will monitor and maintain a suitable hydroperiod of any preserved breeding habitat or potentially suitable breeding habitat, including measures Stanford will take to provide supplemental water if needed to support successful tiger salamander reproduction (if surveys indicate that tiger salamander larvae are present, but forecasts indicate insufficient rain to sustain tiger salamander breeding ponds through metamorphosis), (2) vegetation and sediment management measures, including suitable vegetation to facilitate tiger salamander dispersal between preserved breeding and upland habitat, (3) measures to maintain a suitable number of ground squirrel burrows within preserved upland habitat areas, and (4) an adaptive management plan. Stanford will submit a draft Easement Monitoring and Management Plan to the Service no less than 60 days prior to recording the first conservation easement within the CTS Reserve, and all future habitat preserved within the CTS Reserve will be subject to the approved plan.
- Five years before the expiration of the HCP and associated incidental take permits, Stanford will prepare a long-term monitoring and management plan for all habitat within the CTS Reserve that has been permanently preserved. The long-term monitoring and management plan will incorporate management and monitoring techniques that have been demonstrated to be the most successful. The long-term monitoring and management plan will include protocols for monitoring the abundance of California tiger salamanders and garter snakes in permanently preserved areas and the quality of preserved habitat, invasive species monitoring and management, an adaptive management provision, and any other monitoring or management techniques that Stanford deems necessary to fulfill the conservation purpose of the conservation easement(s) recorded during the term of the HCP. This monitoring and management plan will survive the expiration of the incidental take permits and this HCP, and will be subject to review and approval by the Service.

4.3.3.3 Use of CTS Reserve to Mitigate Future Development

Stanford will also use the CTS Reserve to mitigate for any future losses of Zone 1, 2 or 3 habitat within the California Tiger Salamander Basin (Figure 4-5). Currently, Stanford does not have any plans to develop any Zone 1, 2, or 3 land within the California Tiger Salamander Basin. However, if development occurs within the California Tiger Salamander Basin during the term of the HCP, Stanford would mitigate the loss of habitat by recording a permanent conservation easement over habitat within the CTS Reserve prior to groundbreaking in accordance with the ratios described in Section 4.4. Stanford may accrue mitigation credits by recording larger easements than are necessary to mitigate for a particular project. Surplus mitigation credits will be held in the CTS Account, and Stanford may use them at a later date to mitigate for future development projects or other permanent land conversions.

By requiring Stanford to permanently conserve habitat within the CTS Reserve, the HCP ensures that the permanent loss of habitat will be mitigated by the permanent conservation of habitat. The permanent conservation easements would first be recorded in areas that contain breeding ponds and immediately adjacent upland habitat, and subsequently recorded easements would expand outward from there. All of the conservation easements would be contiguous, and over time a single large block of permanently preserved California tiger salamander breeding and upland habitat would be established. Before recording any conservation easements, Stanford will consult with the Service regarding the location of the new easement.

4.3.3.4 Central Campus CTS Monitoring and Management Plan

As discussed in Chapter 2, California tiger salamanders currently breed at Lagunita, an artificially created reservoir that is supported by diversions of water from San Francisquito Creek.

Govenor Stanford began diverting water to Lagunita in the late 1800s to provide stock water and store irrigation water. Later, Stanford University diverted water to Lagunita to support aquatic recreational activities. However, Stanford no longer uses Lagunita for stock water, water storage, or recreational purposes, but has continued to divert water from San Francisquito Creek to sustain California tiger salamander reproduction. Lagunita also currently provides some flood control functions, and naturally retains some water during the rainy season. However, without the water diversions, in most years Lagunita would not naturally hold enough water for California tiger salamander reproduction. The practice of withdrawing water from San Francisquito Creek and diverting it to Lagunita to facilitate California tiger salamander reproduction can adversely affect biological resources (including steelhead) in the creek.

Lands north, east, and west of Lagunita are developed with urban facilities and do not provide sustainable upland habitat. Consequently, tiger salamanders that breed at Lagunita generally migrate south and across Junipero Serra Boulevard to upland habitat in the undeveloped foothills that will now be part of the CTS Reserve. Junipero Serra Boulevard is a heavily traveled County roadway, and numerous California tiger salamanders are killed annually while migrating across the roadway.

Garter snakes also are sometimes found around Lagunita. However, because Lagunita is regularly used by students, and other people, and lands north, east, and west of Lagunita are already developed with urban facilities including roads, the area does not provide long-term suitable habitat. Garter snakes, like the California tiger salamanders, also are likely killed while crossing roads, and would benefit from habitat management in the foothills.

Since much of Stanford's California tiger salamander population and garter snake population is currently concentrated around Lagunita, Stanford will implement a Central Campus CTS Monitoring and Management Plan that will govern the management of the approximately 95 acres of Zone 1 and 2 California tiger salamander and garter snake habitat north of Junipero Serra Boulevard, including Lagunita (i.e., the "Central Campus CTS Management Area" shown in Figure 4-5). This Central Campus CTS Monitoring and Management Plan will consist of the following monitoring and management measures.

- Surveys for the California tiger salamander and garter snake and their habitat will be conducted in accordance with the monitoring program set forth in Section 4.6 for the term of this HCP.[12]
- If the monitoring program results show that non-native species are adversely affecting Covered Species within the Central Campus CTS area, such as through direct kill or alteration of the habitat to the extent that it reduces its suitability to support the species, the non-natives will be removed, as allowed by law and to the extent that Stanford can feasibly remove or control them. Before trapping is used to remove the non-natives in areas where any Covered Species may occur, Stanford will submit a plan to the Service for approval.
- If the monitoring program results show that non-native plant species could adversely affect Covered Species or their habitat within the Central Campus CTS area, the non-natives will be removed, to the extent that Stanford can feasibly remove or control them.
- If the surveys determine that wildlife species have been placed in Lagunita, Stanford will post signs prohibiting the release of any wildlife species in Lagunita.
- Continue to operate Lagunita consistent with the Lagunita operations plan described in Section 3.1.3.
- Development, such as academic buildings, residential dwelling units, or commercial buildings, will be prohibited in the Lagunita area that is shown on Figure 5-1.[13] Utilities and other general infrastructure improvements that would not adversely affect the tiger salamander habitat and tiger salamander dispersal may be placed within the Lagunita area. However, these improvements will be reviewed by the Conservation Program Manager, and if necessary, the Conservation Program Manager may impose use conditions and restoration measures.

[12] While the San Francisco garter snake is the Covered Species, monitoring will consider all garter snakes in order to gather data on the species and its subspecies. Because garter snakes have been found in Lagunita, surveys for the San Francisco garter snake will be performed in the Central Campus CTS Management Plan area.

[13] If the HCP is amended or authorization is otherwise granted by the Service to allow development within the Lagunita area, Stanford will ensure that a minimum of three breeding ponds in the CTS Reserve have achieved the success criteria described in Section 4.3 before such development occurred.

- No biocides will be applied to Lagunita for schistosome cercarial dermatitis (swimmer's itch) without prior approval of the Conservation Program Manager.
- The bed of Lagunita will be mowed to not less than 4 inches, instead of being disced, for fire protection in the summer after consultation with the Conservation Program Manager. Mowing will be done by the lightest vehicle capable of mowing the area and will be done either in the morning when it is still cool or during the hottest part of the day.
- Ill-fitting utility box covers within 1,500 feet of Lagunita will be retrofitted to exclude California tiger salamanders.
- The use of off-road vehicles in Lagunita will be prohibited and the Conservation Program Manager will inspect Lagunita monthly to ensure compliance with the prohibition.
- Feral cat feeding stations will not be permitted in the Central Campus CTS Management Area, or within 150 feet of the Central Campus CTS Management Area.
- A California tiger salamander and garter snake education program will be developed by the Conservation Program Manager and presented annually to maintenance workers that regularly work in the Central Campus CTS Management Area and to contractor personnel before they begin work in the Central Campus CTS Management Area.

4.4 USE OF MITIGATION ACCOUNT CREDITS

The development or other conversion of existing Zone 1, 2, or 3 habitat will adversely affect the Covered Species. Credits will be withdrawn from the applicable Riparian Account in accordance with the ratios described below for any loss of habitat within Zone 1 or 2 or land in Zone 3 in the Matadero/Deer Creek Basin or San Francisquito/Los Trancos Creek Basin. Likewise, credits will be withdrawn from the CTS Account in accordance with the ratios described below for any loss of habitat within Zone 1 or 2, or land in Zone 3 in the California Tiger Salamander Basin. Zone 1, 2, or 3 habitat may be lost 1) directly through development, which would include the footprint of any new structure, landscaping, or new impervious surface commonly associated with development; and 2) indirectly if new development isolates areas beyond the footprint of the new development. For example, an indirect loss of habitat would occur if new development is sited in a manner that isolates breeding or upland habitat. Under the HCP, the isolated habitat is a loss of habitat that would require mitigation. The Conservation Program Manager will review all new development in Zones 1, 2, and 3 and determine the actual loss or conversion of habitat.

To mitigate for the loss of Zone 1, 2, or 3 habitat within the California Tiger Salamander Basin, mitigation will take the form of either a withdrawal of credits from the CTS Account (if credits have been accrued as discussed above), or by permanently recording a conservation easement over land within the CTS Reserve, in accordance with the ratios described below.

Every acre of Zone 1 habitat that is permanently converted will require three mitigation credits, every acre of Zone 2 habitat will require two mitigation credits, and every acre of Zone 3 land will require 0.5 mitigation credits. Development in Zone 4 will not adversely affect the Covered Species, because Zone 4 does not provide suitable habitat for the Covered Species. Therefore, no mitigation credits are required for development in Zone 4 (Table 4-3).

Table 4-3 Mitigation Ratios for each Habitat Management Zone

Management Zone	Credits Required Per Acre Of Converted Habitat
Zone 1	3
Zone 2	2
Zone 3	0.5
Zone 4	0

Under the HCP, Stanford will have to withdraw credits from the Riparian Accounts or CTS Account to offset habitat lost to development or other activity that results in the permanent conversion of land in Zone 1, 2, or 3. Stanford will offset the loss of habitat by withdrawing credits from the appropriate mitigation Account. By requiring Stanford to pay for development with existing credits, or to earn new credits before habitat is lost to development, mitigation will always stay ahead of development.

Any permanent conversion of Zone 1, 2, or 3 habitat must be paid for from the appropriate Account. Any development or permanent conversion of land in Zone 1, 2, or 3 within the Matadero/Deer Creek Basin (Figure 4-4) must be mitigated for by withdrawing credits from the Matadero/Deer Riparian Account. Any permanent conversion of Zone 1, 2, or 3 habitat within the San Francisquito/Los Trancos Creek Basin (Figure 4-3) must be mitigated for by withdrawing credits from the San Francisquito/Los Trancos Riparian Account, and any development within the California Tiger Salamander Basin (Figure 4-5) will be paid for from the CTS Account.

4.5 ADAPTIVE MANAGEMENT

4.5.1 Adaptive Approach

Adaptive management is an iterative system of decision making that is particularly useful in the face of uncertainty. Adaptive management employs a "learning by doing" approach to resource management that reduces the uncertainty that is inherent in resource management.

Adaptive management begins by using predictive modeling based on present knowledge to inform management and resource conservation decisions. As new knowledge is gained, the models are updated and management decisions adapted accordingly.

Key features of the HCP's adaptive management are:

- Iterative decision-making (evaluating results and adjusting actions on the basis of what has been learned through monitoring);
- Feedback between monitoring and decisions (learning); and
- Measuring success of the Conservation Program in light of the HCP's Biological Goals and Objectives.

Based on the best scientific information currently available, Stanford expects that the HCP's Conservation Program will effectively achieve the HCP's Biological Goals and Objectives. However, there is always some uncertainty with resource management techniques and a risk that habitat conditions will change in unexpected ways. It is also possible that new and different management techniques that are not identified in the HCP will prove to be more effective in achieving the Biological Goals and Objectives, and that scientific data will provide new information about the ecology of the Covered Species and their habitat needs.

Adaptive management is a process by which the Conservation Program for the HCP may be adjusted over time to reflect new information on the life history or ecology of the Covered Species generated through new information on the effectiveness of the various minimization and mitigation measures (in particular, enhancement and management activities). Moreover, the HCP recognizes that conditions at the University may change over the life of the HCP, and this provision provides Stanford with an opportunity to further benefit the Covered Species in the future in response to changed conditions. The adaptive management provision addresses the process for revising the Conservation Program, including changes to the enhancement and management techniques, the use of experimental techniques in enhancement and management activities, revising various plans adopted pursuant to the HCP, emergencies, and reintroducing Covered Species. Other protected species historically found in the region may be proposed for reintroduction at Stanford. Any reintroduction will require active

coordination between Stanford and the appropriate resource agency, and may require an amendment to this HCP.

4.5.2 Role of Monitoring in Adaptive Management

Stanford is responsible for monitoring the status of the Covered Species and the effectiveness of the Conservation Program. The monitoring program implemented under the HCP will evaluate:

- The success of management measures in preserving the quality of existing habitat;
- The success of enhancement measures;
- Species response to habitat conditions;
- Trends in habitat conditions and the Covered Species' population

Monitoring is the cornerstone of adaptive management. Monitoring yields results that inform management decisions. It provides data that Stanford will rely on to identify successful management and monitoring techniques that are achieving the HCP's Biological Goals and Objectives, and identify ineffective management and monitoring techniques. In this way, the monitoring program also provides valuable data for assessing the success of the Conservation Program in meeting the HCP's Biological Goals and Objectives.

4.5.3 Modification to the Conservation Program

During the life of the HCP, Stanford may modify the Conservation Program to reflect new scientific or technical information (such as the adoption of a federally approved Species Recovery Plan described further in Section 6.9.4), the designation of Critical Habitat, or if the monitoring program shows that measures provided for in the HCP are ineffective or that Stanford is not progressing towards achieving the HCP's Biological Goals and Objectives. Minor amendments may be required as management practices progress and improve. Likewise, as the University and technologies for running the University evolve, some of the Covered Activities may change to reflect that evolution. The minimization measure may change to adapt to those changes in the University's Covered

Activities. Adaptive management may be used to modify the Conservation Program to reflect these changes. Modifications made through adaptive management would generally reflect changes to the management of the habitat or the performance of new conservation-related activities and will be limited to:

- changes to monitoring methodologies and timing, including those resulting from ongoing research on the Covered Species;
- changes to the monitoring methodologies or management techniques based on the adoption of a federally approved Species Recovery Plan or designation of critical habitat;
- decisions to develop population viability indices having to do with specific population monitoring techniques;
- any revisions of a minor or technical nature to the monitoring and management plans developed under this HCP;
- changes to Best Management Practices;
- changes to the Minimization Measures pursuant to Section 4.5.4, below;
- minor changes or additions to the Covered Activities that do not introduce significant new biological impacts into the San Francisquito/Los Trancos Easement, Matadero/Deer Easement, or CTS Reserve, or result in significant new or different environmental impacts; and
- any other revision of a technical nature that is consistent with the overall biological intent of the HCP and does not introduce significant new biological conditions into an area covered by the HCP or result in significant new or different environmental impacts.

Any changes made pursuant to this section will be described in the Annual Report (described in Section 6.4).

4.5.4 Revisions to the Conservation Measures

If the Annual Report (required under Section 6.4 of the HCP) or other biological monitoring reports indicate consistent population declines in a Covered Species when compared to population numbers provided in previous reports, and the best available scientific data indicate that the consistent population decline is attributable to an activity being performed by Stanford, then Stanford and the Service or NOAA Fisheries will meet and confer to determine if the minimization and/or land management and conservation measures described in Section 4.2 are inadequate or may be responsible for or contributing to the population declines. If the parties agree that the best available scientific information shows that the minimization measures are responsible in whole or in part for such population declines, and if new techniques of substantially equal cost are available for more effectively implementing the measures, then revisions to Section 4.2 of the Conservation Program will be made as soon as practicable. Any such changes will be reviewed and approved by the agency with jurisdiction over the particular Covered Species before any changes are implemented, and will be made in accordance with the process set forth in Section 6.7.2, under Minor Modifications.

4.5.5 Revisions to the Monitoring and Management Plans

Under the Conservation Program, Section 4.3, Stanford is required to implement multiple Monitoring and Management Plans for the benefit of the Covered Species. These Monitoring and Management Plans are intended to gauge the effectiveness of the HCP's Conservation Program in achieving the Biological Goals and Objectives, and to preserve and enhance the conservation value of the San Francisquito/Los Trancos Easement, Matadero/Deer Easement, CTS Reserve, or Central Campus CTS Management Area. However, if the Annual Report or other biological monitoring reports indicate a consistent population decline for a Covered Species when compared with previous reports, and the best available scientific data indicates that the consistent population decline is attributable to an activity being performed by Stanford, then Stanford and the Service or NOAA Fisheries, depending upon which agency has jurisdiction over the species (identified in text below as "appropriate agency", shall meet and confer to determine whether or not the management techniques (and if so, which management techniques) require adjustment to reverse the population declines.

If Stanford, with the concurrence of the appropriate agency, concludes that management techniques are either entirely or partially responsible for population declines of a Covered Species, then revisions will be made to the appropriate management techniques. Some examples of appropriate changes include:

- Replace techniques with a more effective technique: The preferable method for solving any problems with a management technique is to eliminate a management technique that has yielded little or no measurable benefits to the Covered Species and re-direct those resources to alternative strategies that are more likely or proven to provide enhanced benefits to the Covered Species. A new method will be employed if it is roughly equivalent in cost to the eliminated technique.
- Add new management techniques: In some cases, new management techniques may be essential to assist in maintaining the Covered Species populations but Stanford cannot implement the new techniques without raising the overall cost of managing the San Francisquito/Los Trancos Easement, Matadero/Deer Easement, CTS Reserve, or Central Campus CTS Management Area. In such cases, the new management techniques may be implemented, but only if funding sources (e.g., state or federal funds) are obtained such that the overall costs of implementing the HCP are not increased.

Alternatively, if new techniques that may improve habitat quality or Covered Species survival become available, even if no detectable Covered Species population decline has been noted, then Stanford may meet and confer with the appropriate agency to determine if the implementation of such new techniques is desirable.

Likewise, Stanford may find that the monitoring techniques are ineffective, or that more effective monitoring techniques may exist. For example, field surveys may fail to encounter the Covered Species or only rarely encounter remnant populations of a Covered Species such that the biological data gathered from the surveys fails to provide suitably reliable evidence of the success of the HCP. Similarly, Stanford may, from time to time, need to revise the methods and techniques for surveying or otherwise monitoring the Covered Species in order to provide meaningful data, to respond to new scientific information, or to respond to the results and experiences of current monitoring methodologies. If Stanford, with the concurrence of the appropriate agency, concludes that the monitoring techniques being used are inadequate or that better techniques are available, then revisions to the appropriate techniques may be made. Stanford will meet and confer with the appropriate agency regarding any new monitoring technique. The new techniques may be implemented if Stanford determines they are feasible, and the appropriate agency concurs that the new technique will provide more reliable or efficient data, without creating any new adverse effects on the Covered Species.

Any changes made pursuant to this section will be described in the Annual Report (Section 6.4).

4.5.6 Experimental Techniques

The HCP does not require the use of new or untested techniques. However, from time to time, Stanford may find that a new but untested or different technique has the potential to improve habitat quality or to improve the survival of the Covered Species. This section describes the requirements for incorporating such new or different techniques into the HCP.

If a management technique is new or untested at Stanford (and many are, since the art and science of natural land management and restoration are constantly changing), the technique should be treated as a new technique. The need for the technique should be carefully documented and reviewed by scientific peer review and should, if at all possible, be carried out on a small scale prior to treating large portions of land that might represent a significant percentage of habitat for a target Covered Species. If the technique proves successful, it may be used on a larger scale. At every stage, the actual methods used must be documented and the results monitored to test whether the anticipated effect on the habitat and the actual effect on the target Covered Species' populations are achieved.

Prior to undertaking an unproven enhancement or management technique in the San Francisquito/Los Trancos Easement, Matadero/Deer Easement, CTS Reserve, or Central Campus CTS Management Area, Stanford will meet and confer with the Service or NOAA Fisheries to determine appropriate methodologies and protocols, the total acreage that would be subject to the new techniques, and the success criteria which must be demonstrated by the new technique before the experimental technique may be extended. Implementation of such measures or new techniques shall require the concurrence of the agency with jurisdiction over the particular Covered Species that would be affected.

4.5.7 Introduction of Threatened or Endangered Species

Historical data indicate that three demographic units of the Bay checkerspot butterfly (*Euphydryas editha bayensis*) inhabited Jasper Ridge Biological Preserve, but became extinct at the Preserve by 1998. However, the Preserve still supports serpentine grassland habitat that has been designated by the Service as Critical Habitat for the butterfly. During the life of the HCP, Stanford may try an experimental reintroduction of the butterfly or other protected species, and study the persistence of the species. Prior to re-introducing any federally protected species, Stanford, with the concurrence of the Service and/or NOAA Fisheries, will determine the biological appropriateness of such a reintroduction, the timing of collection and reintroduction of this species, appropriate source population, requirements for encouraging survival of these animals, and other protocols and methodologies as appropriate. If the butterfly is introduced, the HCP may be amended in accordance with Section 6.7.1, to include the butterfly as a Covered Species.

4.6 HCP MONITORING PROGRAM

This section describes the HCP's monitoring program. However, it will likely evolve during the life of the HCP through the adaptive management process. Adaptive management will be employed to add new monitoring techniques, modify these monitoring methods or eliminate monitoring methods that prove ineffective or that have unanticipated impacts on the Covered Species. To maintain an internally consistent and comparable dataset, methods will be used as long as they are providing useful information and not having unanticipated impacts on the Covered Species, and any changes to the methods will be reported in the Annual Report.

As discussed in Section 4.5, the monitoring program has been developed, in part, to measure the Conservation Program's success in achieving the HCP's Biological Goals and Objectives, and monitoring is an important component in the adaptive management process. The monitoring program outlined below will provide data on the distribution and abundance of the Covered Species, their habitats, and potential threats. Using these data, Stanford will be able to assess changes in the quality and quantity of the specific habitat of the Covered Species, identify significant changes in the populations of the Covered Species, measure progress towards meeting the HCP's Biological Goals and Objectives, and decide if changes in management or monitoring are warranted. The results of the annual monitoring activities will also inform management decisions, including restoration efforts and invasive species removal.

The monitoring program has been organized by species, although monitoring activities will be aggregated during the implementation of the HCP for several species that use the same habitat. For example, San Francisquito Creek provides habitat for steelhead, red-legged frogs, western pond turtles, and garter snakes, so several of the monitoring activities that pertain to these species may be done at the same time. In this way, Stanford will minimize the potential impacts of these monitoring activities on the species.

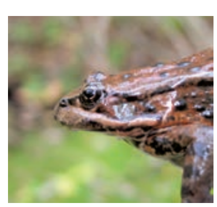
The Conservation Program Manager will serve as the primary responsible individual for the taking of any Covered Species that may occur during the course of implementing the HCP's monitoring program. All monitoring activities will be performed under the Conservation Program Manager's guidance and supervision, or under the guidance and supervision of an agency-approved assistant Conservation Program Manager. Stanford will ensure that the lead or assistant Conservation Program Manager is onsite during all monitoring activities. Prior to the implementation of the HCP, Stanford will provide the Service and NOAA Fisheries with resumes for the Conservation Program Manager and any assistant Conservation Program Manager(s) for approval. Stanford will notify the Service and NOAA Fisheries no less than 14 days in advance of any monitoring activities if there is a new lead or assistant Conservation Program Manager, and provide them with a resume or similar description of qualifications. Stanford University scientists and students will generally assist the lead or assistant Conservation Program Manager with implementing the HCP's monitoring activities.

Prior to the implementation of the HCP, the Conservation Program Manager will prepare a training program to ensure that all individuals performing monitoring activities have qualifications, knowledge and experience relevant to the type of research and monitoring activities that are being performed. A list of all individuals who participated in the monitoring activities and copies of training materials will be submitted to the Service and NOAA Fisheries with the Annual Report (described in Section 6.4).

The Conservation Program Manager may engage third parties (such as biological consultants with specific technical expertise regarding a Covered Species) who are qualified and authorized by the Service or NOAA Fisheries to conduct, or to directly supervise, activities conducted under the HCP's monitoring program without the on-site presence or supervision of the Conservation Program Manager. Prior to delegating any monitoring activities to a third party, Stanford will notify the Service or NOAA Fisheries, depending on the species affected, and will not delegate any monitoring activities to a third party without the applicable agency's approval.

Monitoring results will be included in the Annual Report.

4.6.1 California red-legged frog monitoring



California red-legged frogs have been surveyed annually at Stanford since the mid-1990s. Prior to the initiation of these annual surveys, specimens of California red-legged frogs were collected at Stanford, but the species was not the focus of specific field efforts. Night surveys have proved to be the most useful technique for monitoring the frogs at Stanford, but day surveys also have been found to yield information useful to conservation planning efforts. Recent records of red-legged frogs at Stanford indicate that the local frogs reproduce mainly in slow-flowing portions of Deer, Matadero, and San Francisquito creeks. Some reproduction also occurs in a small pool located in an old quarry near Matadero Creek. Surveys for egg masses in these creeks have not yielded consistent results. The following monitoring program is based, in part, on Stanford's experience with various monitoring techniques, prior survey results, historical records, and the presence of potentially suitable California red-legged frog habitat.

Night surveys of areas recently occupied[14] by California red-legged frog

- Three times a year, occurring from late spring to early fall, Stanford will perform visual night surveys of portions of San Francisquito, Los Trancos, Matadero (including the "Quarry Pond"), and Deer creeks that have recently been occupied by California red-legged frogs. The survey areas will bracket the recently occupied areas by at least 500 feet.
- The night surveys will assess the number of adult and juvenile California red-legged frogs, and larval frogs (tadpoles) and non-native species such as bullfrogs. The location, size, and sex of the frogs will be recorded. The presence of any egg masses also will be noted; however, it is anticipated that all California red-legged frog eggs will have hatched by the time these surveys performed.
- The surveys will be performed under the guidance of the Conservation Program Manager, and will typically include two persons walking through the creek and along the adjacent riparian zone with headlamps and/or flashlights.
- If there is inconclusive evidence that suggests an area is occupied (e.g., a ranid frog unidentified to species or hearing a "plop"), at least two follow-up surveys will be conducted.

Night surveys of potentially occupied areas

- Every 2 years Stanford will perform a night time visual survey along reaches of San Francisquito, Bear, Matadero, and Los Trancos creeks that are not included in the annual night time survey. Any of the small unnamed, seasonal tributaries which are deemed potential red-legged frog habitat along with Felt and Searsville reservoirs, and Skippers Pond, will also be surveyed every 2 years.
- The night surveys will assess the number of adult and juvenile California red-legged frogs and larval frogs (tadpoles). The presence of any egg masses also will be noted; however, it is anticipated that all red-legged frog eggs will have hatched by the time these surveys are performed.
- The surveys will be performed under the guidance of the Conservation Program Manager, and will typically include two persons walking through the creeks and tributaries and along the adjacent riparian corridors with flashlights and/or headlamps.
- If red-legged frogs are observed during these surveys, the sites will be considered occupied areas will be added to the areas surveyed annually.
- If there is inconclusive evidence that suggests an area is occupied (e.g., a ranid frog unidentified to species or hearing a "plop"), at least two follow-up surveys will be conducted.

Day surveys of suitable habitat

- At least once a year, occurring during late spring to early fall, Stanford will visually survey all reaches of San Francisquito, Los Trancos, Bear, Deer and Matadero (upstream from Foothill Boulevard, including the "Quarry Pond") creeks passing through Stanford lands, the adjacent riparian zone, Felt and Searsville reservoirs, and Skippers Pond to assess the overall condition of the waterways and adjacent riparian zone.
- While not the primary focus of this effort, these day surveys will assess the number of adult and juvenile California red-legged frogs, and larval frogs (tadpoles) and non-native species such as bullfrogs and centrarchid fishes. The presence of any egg masses also will be noted, however, it is anticipated that all California red-legged frog eggs will have hatched by the time these surveys are performed.
- The surveys will be performed under the guidance of the Conservation Program Manager and will include snorkel surveys and walking through the creeks and adjacent riparian zones.
- If red-legged frogs are observed during these surveys, these locations will be considered occupied and will be added to the areas surveyed annually (see night surveys of areas recently occupied, above).
- If there is inconclusive evidence that suggests an area is occupied (e.g., a ranid frog unidentified to species or hearing a "plop"), at least two follow-up surveys will be conducted.

[14] For purposes of this HCP, "recently occupied" means that the species in question has been recorded from the particular location within the last 5 years.

Habitat monitoring

- The physical condition of the waterways and surrounding vegetation will be assessed during annual field visits, noting significant tree loss or falls, declines that may be attributable to disease, and presence of non-native plant species.
- Ten riparian transects will be established in appropriate areas to determine habitat quality for frogs and will be surveyed every 5 years.
- Baseline conditions will be determined within 2 years of the issuance of an incidental take permit by the Service.

Day surveys of other areas

- Every 3 years Stanford will visually survey the portions of creeks found on its lands which are not included in the annual surveys. These reaches include Matadero Creek downstream of Foothill Boulevard, relatively limited portions of Corte Madera, Dennis Martin, Sausal, and Alambique creeks, and any of the unnamed seasonal tributaries which are considered potentially suitable California red-legged frog habitat.
- These surveys will be conducted between late spring and early fall.
- The surveys will be performed under the guidance of the Conservation Program Manager and will include snorkel surveys and walking in shallow areas of the creek/tributaries and along the adjacent riparian corridors.
- If California red-legged frogs are found during these surveys, these areas will be added to locations addressed by the annual night surveys (see protocol for "night surveys of areas recently occupied").
- If there is inconclusive evidence that suggests an area is occupied (e.g., a ranid frog unidentified to species or hearing a "plop"), at least two follow-up surveys will be conducted.
- The physical condition of the waterways and surrounding vegetation will also be assessed during these field visits.

Day surveys of created off-channel ponds

- Stanford will survey the constructed ponds and the surrounding upland areas every 3 weeks beginning in January and continuing through July in order to locate egg masses and track their progression as tadpoles and metamorphs.
- Pond surveys will include dip netting, visual observations, and use of metering equipment.
- Surveys will include four transects every 3 years to determine open water, emergent vegetation, shoreline vegetation, and upland vegetation.
- Basic water quality parameters will be measured during each interval (e.g., water level, conductivity, clarity).

4.6.2 Steelhead monitoring

Surveys of the creeks and bodies of standing water have been conducted annually at Stanford since the late 1990s. The majority of this work has been conducted during the low-flow period of summer, with few spring and fall field activities. These field efforts have included visual day and night surveys, snorkel surveys, electrofishing, and trapping (mainly targeting non-native fishes and crayfish). Extensive electrofishing was conducted from 1997 to 2001. During these years, virtually all of the San Francisquito Creek system on Stanford property was electrofished multiple times annually, with intensive single-pass sweeps. Recent work has focused on snorkel surveys, and approximately 50 percent of the reaches with sufficient depth and clarity were snorkeled annually during the last few seasons. Redd surveys have not been conducted on a regular basis in the relatively small creeks at Stanford. Stanford has concluded that because of the dense vegetation surrounding the active creek channel, large changes in flow, and relatively small redd size, redd surveys at Stanford would provide limited information and would be potentially detrimental to the species. The following monitoring program is based, in part, on Stanford's experience with various monitoring techniques, prior survey results, historical records, and the location of steelhead spawning and rearing habitat.

Surveys of reference reaches

- Three times a year, Stanford will survey no less than 10 percent of the total length of Bear, San Francisquito, and Los Trancos creeks on Stanford property to estimate the abundance and age classes of fish species present. The survey reaches will be chosen on the basis of previous surveys and include areas with historically high and low steelhead densities, different types of physical parameters (channel morphology, substrate, etc.), and different adjacent land uses. Generally, the same reaches will be monitored each year, but if warranted by significantly changed conditions, such as major reshaping of creek channel or an extended drought, the specific reaches surveyed will be altered.

- Survey methods will include electrofishing where possible, snorkeling, and walking in areas that are too shallow to snorkel. Electrofishing will only be used in reaches not recently occupied by California red-legged frogs, and will be conducted in accordance with NOAA Fisheries' "Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act, June 2000"[15]. Electrofishing will include the appropriate use of block netting.
- Surveys will assess the physical condition of the creek, including type and location of barriers and critical riffles, the location of pools sufficient to provide rearing habitat, the distribution and abundance of instream cover such as large woody debris, substrate characteristics, and water quality.
- The number of steelhead within the different age-classes will be estimated for the reference reaches.
- The surveys will occur roughly equally spaced during the period from late spring to early fall and will be performed under the guidance of the Conservation Program Manager.
- These surveys will also provide information on the distribution and abundance of native and non-native species.

Day surveys of suitable habitat

- At least once a year, Stanford will visually survey all reaches of San Francisquito, Los Trancos, Bear, Deer and Matadero (upstream from Foothill Boulevard) creeks passing through Stanford lands and the adjacent riparian zone to assess the overall condition of the creeks and adjacent riparian zone (areas not included in the reference reaches).
- These surveys will:
  - — identify barriers to fish dispersal,
  - — identify areas for potential instream habitat enhancement projects such as the addition of woody debris,
  - — be used to assist in the identification of point sources of sediment entering creeks,
  - — be used to evaluate aquatic habitat conditions for steelhead on Stanford lands and provide gross information on the distribution and abundance of steelhead, other native species, and non-native species, and
  - — be used to evaluate the effects of non-native plant and animal species on steelhead and steelhead habitat.
- These surveys will occur between late spring and early fall.
- Once every 5 years, Stanford will conduct a habitat typing survey. The habitat typing survey will classify habitats as pool, glide, run, riffle, cascade, dry, and other types of habitat found in the stream reaches using techniques such as found in Flosi et al. (1998 and updated 2005). This includes the assessment of the quality of habitat for salmonids by measuring common parameters of habitat quality including gravel permeability, gravel composition, and pool filling by fine sediment. The quantity of habitat currently available for salmonids will then be calculated.

Fish monitoring/counting devices[16]

- Stanford will install an automated fish counting device in Los Trancos Creek.[17] The location of the counting device will be determined by physical requirements of the selected model, access, creek channel structure, and security. A location near the downstream end of Los Trancos Creek, at or near the Piers Lane Bridge, is preferable, but final site selection will be determined by further analyses and discussions with NOAA Fisheries.
- Stanford will maintain, at least seasonally, two underwater video cameras in Los Trancos and San Francisquito creeks. At least one camera will be maintained in each creek, and the locations will be selected based on water clarity, ease of installing/removing the cameras, and availability of a power source for the cameras. Ideally, the video cameras in the creeks will be maintained all year, but it is likely that they will need to be removed during storm events and periods of very low visibility. Stanford will provide NOAA Fisheries, the Service, and other interested local, state, and federal agencies with copies of recorded material,

[15] http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf

[16] The installation of automated fish monitoring or counting devices may require additional local, state, or federal permits. The installation of these devices is, therefore, subject to Stanford's ability to obtain these other necessary permits.

[17] The installation and long-term operation of instream monitoring devices may be difficult due to the often rapid and large fluctuations in flow rate, and frequently, the large amount of debris. A previous attempt at installing an automated fish counting device on the Los Trancos diversion fish ladder was short-lived because the device was destroyed by debris during a sudden storm event.

or preferably, internet access to streaming video. Streaming video systems are preferred, but physical constraints of the creeks and riparian zone may prohibit such a set-up (simple recording systems are much easier to install and maintain, and will be used if streaming video systems are not feasible).

- Stanford will conduct a pilot trapping program to be initiated within 3 years of the approval of the HCP, with one trap on Los Trancos near the confluence with San Francisquito Creek and a second trap on San Francisquito Creek in order to determine numbers and timing of downstream migrating steelhead. Funnel/Fyke-type traps or screw traps will be utilized. Traps will be set in early March and operated through late May for 4 days per week. High-flow events may preclude some sampling. Adult fish captured will be released immediately downstream of the trap. After five seasons of trapping or sooner, Stanford will review the pilot program with NOAA Fisheries to determine the effectiveness of the pilot program and determine whether the trapping program will continue.

4.6.3 California tiger salamander monitoring

California tiger salamanders have been studied at Stanford and in the vicinity of Stanford for more than 100 years, with major research by Professor Twitty in the 1930s and 1940s. Since the early 1990s, the local tiger salamanders have been monitored annually and many techniques have been tried. At Stanford, the most productive monitoring methods are night surveys during the late fall/early winter migration season, and larval surveys during spring (using either minnow traps or dip nets). Occasionally, visual surveys for eggs were successful, depending on water clarity. Egg frames, drift fences, pitfall traps, cover boards, and a number of other techniques have also been tried during these annual efforts, but the value of the results were low, and did not warrant the effort. The following monitoring program is based, in part, on Stanford's experience with various monitoring techniques, prior survey results, historical records, and the presence of suitable breeding habitat.

Rainy season night surveys of salamander dispersal routes

- Stanford will visually survey each of the following areas five times per year, between October and February: (1) Junipero Serra Boulevard, from Campus Drive West to 300 feet south of the Gerona Gate to the foothills; (2) along Campus Drive West, from Junipero Serra Boulevard to Santa Teresa Street; (3) along Campus Drive East, from Junipero Serra Boulevard to the entrance of the Sigma Alpha Epsilon fraternity parking lot; (4) along the foothills service road, from Junipero Serra Boulevard to Reservoir 2 (enclosed water reservoir), and from Junipero Serra Boulevard to the drainage adjacent to the faculty housing, and (5) the pathway circling Lagunita.
- The surveys will assess the distribution and abundance of migrating tiger salamanders, and the locations and approximate numbers of vehicle-caused mortality.

Rainy season night surveys of areas only rarely traversed by salamanders

- Stanford will visually survey each of the following areas at least three times per year, between October and February: (1) Links Road; (2) Governor's Avenue from Campus Drive West to Santa Teresa Street; (3) Electioneer Road, and (4) Lomita Drive, from Santa Teresa Street to its end just past the Knoll, including Lomita Court.
- The surveys will assess the distribution and abundance of migrating tiger salamanders, and the locations and approximate rate of vehicle-caused mortality.
- If five or more salamanders are observed in any of these areas during a given year, that area will be added to the list of more frequently surveyed sites.

Egg mass surveys

- Stanford will visually survey the shallow portions of Lagunita and the constructed ponds in the foothills for tiger salamander egg masses. Visual surveys for egg masses will be done three times between late December and mid-February.

Larval surveys

- The purpose of the larval surveys is to determine whether breeding has been successful and whether the larvae persist and eventually metamorphose. The larval surveys will be used to verify whether successful reproduction has occurred (i.e., whether a larva has transformed into the terrestrial stage). For the purposes of this HCP, once a larva has begun to exhibit the morphological features indicating metamorphosis to the terrestrial stage, it will be assumed that successful reproduction has occurred as long as the pond retains water an additional 2 weeks.

- Stanford will place sets (groups) of minnow traps (1/8 inch mesh), as described below, in Lagunita and the constructed ponds in the foothills every 3 to 4 weeks starting in late February/early March and ending when water temperature/quality becomes suboptimal. A set of traps will consist of 15 collapsible minnow traps. This should produce three to five rounds of trapping per year.
- Traps will be deployed in the late afternoon and retrieved by mid-morning the next day.
- In Lagunita, nine sets will be deployed each round of sampling, with eight sets placed in the shallows around the perimeter of the reservoir, and one set placed at the center of reservoir location. This will result in 135 total trap nights per round of sampling.
- In the foothill ponds, single sets of traps will be deployed in each pond per sampling round. The traps will be placed such that they are located across the depth range of the individual ponds (with the shallowest sited traps being just barely completely submerged).
- If trapping is halted due to temperature increases, monitoring by way of dip netting will occur until the ponds are dry.

General wetland and upland surveys

- Stanford will survey Lagunita, the constructed ponds in the foothills, and the surrounding upland areas every 3 weeks beginning in January and continuing until the ponds and Lagunita dry.
- During each survey, Stanford will determine the: density of mid-water invertebrates; distribution and abundance of amphibians, predominantly eggs masses and larvae; and basic water quality parameters, including water level, conductivity, and clarity.
- Ponds will be surveyed to ensure that there is sufficient cover and substrate suitable for egg mass attachment.
- Surveys of the upland areas will include walking through the grasslands and noting the condition and type of surrounding vegetation (e.g., species composition, rough percent cover, etc.), presence of ground squirrels, and extent of areas of disturbance. The distribution and condition of cover-providing features, such as the constructed cover piles, will also be recorded. Surveys will include four transects every 3 years to determine open water, emergent vegetation, shoreline vegetation, and upland vegetation.

4.6.4 Western pond turtle monitoring

Surveys of the creeks and bodies of standing water have been conducted annually at Stanford since the late 1990s. These field efforts include visual day and night surveys, snorkel surveys, electrofishing, and trapping (mainly targeting non-native fishes and crayfish). During these activities, western pond turtles have been consistently, albeit in low numbers, observed in portions of San Francisquito Creek. They have also been observed less consistently during the repeated annual surveys of Felt Reservoir. The visual day and snorkel surveys have contributed the most data on the distribution of turtles at Stanford, and trapping has been useful in conducting work on known individuals. The following monitoring program is based on prior surveys, historical records, and the presence of potentially suitable western pond turtle habitat.

Habitat monitoring

- The physical condition of the waterways and surrounding vegetation will be assessed during annual field visits, noting significant tree loss or falls, declines that may be attributable to disease, and presence of non-native plant species.
- Ten riparian transects will be established in appropriate areas to determine habitat quality for turtles and will be surveyed every 5 years.
- Baseline conditions will be determined within 2 years of the issuance of an incidental take permit by the Service.
- During turtle surveys the presence of suitable basking platforms along San Francisquito Creek, Searsville Reservoir, Felt Reservoir, and Skippers Pond will be determined.

Day surveys of areas recently occupied by western pond turtle

- Three times a year, occurring from late spring to early fall, Stanford will perform visual surveys of the portions of San Francisquito Creek and Felt Reservoir that have recently been occupied by western pond turtles. Surveys will be conducted 1,500 feet up- and downstream from occupied areas. Searsville Reservoir and Skippers Pond will also be surveyed.
- The surveys will assess the number of adult and juvenile western pond turtle and non-native species such as bullfrogs.
- The creek surveys will include snorkel surveys, and walking in areas that are too shallow to snorkel (visual surveys). The surveys of the reservoirs will be visual surveys.
- Turtles will be captured when possible, either by hand, nets, or with the use of turtle traps. Captured individuals will be photographed, measured, and released at the point of capture.
- These surveys include a visual assessment of the presence and distribution of non-native crayfish, bullfrogs, and fishes.
- If the initial survey cannot conclusively establish that an area is occupied, but there is evidence that suggests an area is occupied (e.g., an unidentified turtle species is found) at least two additional surveys will be conducted.

Day surveys of all creeks and waterways

- Once a year, in the late spring to early fall, Stanford will visually survey all reaches of San Francisquito, Los Trancos, Bear and Deer creeks and all reaches of Matadero Creek upstream from Foothills Boulevard that pass through Stanford lands to assess the overall health of the creeks, including the presence of non-native crayfish, bullfrogs, fishes and the presence of western pond turtles Visual surveys will include snorkeling, and walking in shallow areas and adjacent riparian habitat.
- Every 3 years, Stanford will visually survey all reaches of Matadero Creek on Stanford lands downstream from Foothill Boulevard to assess the overall health of the creeks, including the presence of non-native crayfish, bullfrogs, fishes, and the presence of western pond turtles.
- If western pond turtles are encountered, they will be captured, if possible, photographed and measured, and released at the point of capture.
- If western pond turtles are found during these surveys, these areas will be added to locations addressed by the annual surveys of occupied areas (see above).

4.6.5 San Francisco garter snake[18] monitoring

Surveys for garter snakes at Stanford and in the vicinity of Stanford have been performed sporadically since Stanford University was founded. Surveys conducted since the 1970s have focused on Lagunita, San Francisquito Creek, and near the SLAC National Accelerator Laboratory. The results of these surveys and other historical information are described in Section 2.4.5. Generally, small numbers of garter snakes are found annually at Lagunita, but are very infrequently encountered elsewhere on Stanford lands. Historical data indicate that garter snakes may have occupied other areas at Stanford. More recent riparian surveys, in areas that provide suitable garter snake habitat, focused on steelhead, California red-legged frogs, and western pond turtles, and did not look for garter snakes. The following monitoring program is based, in part, on prior surveys, historical records, and the presence of potentially suitable garter snake habitat.

Baseline distribution surveys

- Within 1 year of the Service issuing an Incidental Take Permit, Stanford will prepare a draft baseline distribution survey plan to establish the distribution of garter snakes.
- The draft plan will identify locations for visual surveys and trapping, and will include, but not be limited to, the following areas:
  - — Matadero/Deer creek riparian zone
  - — Searsville Reservoir (upper, middle and lower portions)
  - — San Francisquito Creek riparian zone
  - — Sausal Creek/Skippers Pond
  - — Lower foothills (constructed CTS ponds and natural wetlands)
  - — Parcel located between Sand Hill Road and the SLAC National Accelerator Laboratory
  - — Lagunita

[18] While the San Francisco garter snake is the Covered Species, monitoring will consider all garter snakes in order to gather data on the species and its subspecies.

- The Service will have 60 days to comment on the draft baseline distribution survey plan, and if Stanford does not concur with the Service's recommendations, Stanford and the Service will confer to develop a mutually agreeable solution and provide a final baseline distribution survey plan within 45 days.
- Stanford will implement the plan.

Final Monitoring Plan

- Following the completion of the baseline distribution survey plan, Stanford will submit a draft monitoring plan to the Service.
- The Service will have 60 days to comment on the draft monitoring plan, and if Stanford does not concur with the Service's recommendations, Stanford and the Service will confer to develop a mutually agreeable solution and provide a final monitoring plan within 45 days.
- Stanford will implement the monitoring plan.

SECTION 5
POTENTIAL BIOLOGICAL IMPACT/TAKE ASSESSMENT

5.0 POTENTIAL BIOLOGICAL IMPACT/TAKE ASSESSMENT

5.1 DEFINITION OF TAKE

Under the Federal Endangered Species Act (ESA), take of wildlife species listed as threatened or endangered is illegal, unless authorized by an incidental take permit or other means. 16 USC §1539(a). The ESA defines the term "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." 16 USC §1533(19). By regulation, the Service and NOAA Fisheries have defined the terms "harm" and "harass" in the definition of "take." "Harm" means "an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." [1] "Harass" means "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." 50 CFR §17.3.

5.2 IMPACTS CONSIDERED UNDER THE HABITAT CONSERVATION PLAN

Under Section 10(a)(2) of the ESA, an HCP must identify the incidental take of listed species that is anticipated, and the impacts that will likely result from such taking. Before the Service or NOAA Fisheries can approve an HCP and issue the requested incidental take permit, they must conduct an internal Section 7 consultation on the HCP, which will lead to a Biological Opinion as to whether implementation of the incidental take permit and HCP will (1) result in "jeopardy" to any listed species of plant or animal, or (2) result in the "destruction or adverse modification" of designated Critical Habitat. In doing its Section 7 consultation, the Service and NOAA Fisheries must look not only at the direct effects (i.e., anticipated incidental take resulting from the HCP) but also indirect and cumulative effects.

Following the preparation of a Biological Opinion, the Service and NOAA Fisheries will issue an incidental take permit upon a finding, in addition to other criteria, that the Covered Activities will not appreciably reduce the likelihood of the survival and recovery of the species in the wild, and that Stanford has minimized and mitigated the effects of their activities to the maximum extent practicable. The Minimization Measures and Conservation Program described in Section 4.0 have the ability to fully mitigate impacts to the Covered Species and therefore reduce the direct, indirect, and cumulative effects of the Covered Activities, and provide benefits to the Covered Species, such that the Service and NOAA Fisheries should be able to make a finding that meets the two most critical criteria above.

To meet the requirements of Section 10(a)(2), and facilitate the Biological Opinion and incidental take process, this HCP evaluates anticipated incidental take, and associated direct, indirect, and cumulative effects.

5.3 ANTICIPATED TAKE OF EACH COVERED SPECIES

Stanford University was established more than 100 years ago, on the site of Governor Stanford's famous Palo Alto stock farm. The type and frequency of the activities needed to run the University have evolved over the past 100 years, and will continue to evolve. However, the University has substantial information about its modern operations and anticipated future operations, and a substantial amount of information about the distribution and population of the Covered Species at Stanford, and based on the available data, evaluated the projected future take of the Covered Species by Stanford. Although direct and indirect take is not defined in the ESA, for the purposes of describing the anticipated impacts to the Covered Species, the HCP uses these terms as defined below.

Direct take as used in the HCP refers to the harm, harassment, and loss of individuals of the Covered Species. This includes losses from direct actions, such as stepping on an individual of a Covered Species; construction machinery harassing, injuring or killing an individual during development; or accidental harm, harassment or death of a species during the course of activities such as non-native species control efforts. Direct take also includes harassment, harm, or the death of a species that occurs during ongoing activities that disrupt the species' habitat for a short time, such as maintaining buried utilities that are occasionally excavated and subsequently reburied. Individual Covered Species may not be directly killed by the habitat disruption, but such disruptions can significantly alter the species' behavior and cause a temporary increase in the rate of mortality caused by some secondary factor, such as predation or desiccation. Species such as the western pond turtle and steelhead are more susceptible to disruption of their habitat than other species. For example, female turtles will discontinue seeking nest locations if they are scared by human activity and steelhead may strand themselves in shallow waters or even flip themselves onto the bank when people are working in the creek. Conversely, California tiger salamanders are less easily disturbed, and temporary disturbances to their habitat generally do not result in increased rates of mortality for these species. A summary of the anticipated level of incidental mortality is provided in Table 5-1.

[1] NOAA Fisheries has a very similar definition of harm that also includes spawning, rearing, and migration as essential behavioral patterns. 50 CFR 222.

Indirect take as used in the HCP describes the permanent loss of habitat that is not expected to result in the mortality or direct harm or harassment of a species. Reducing the amount of available habitat may reduce the future maximum size of the species' populations. This reduction in the potential maximum size of the population can affect a local population's persistence or may inhibit efforts to recover the species. The permanent loss of habitat can be more of a threat to a species' local persistence than the occasional loss of a few individuals, and is therefore considered take under the HCP. A summary of the anticipated loss of habitat is provided in Table 5-2. Potential locations and amount of habitat loss are provided in Figure 5-1.

The anticipated levels of take described below, and the anticipated incidental mortality shown in Table 5-1 reflect the current population levels. The implementation of the HCP's Conservation Program will likely increase the population of the Covered Species during the life of the HCP. As the population increases, the number of individuals that are harassed, harmed, or killed may increase numerically. However, the impact to the population as a whole will decrease because a numerically robust population has a much better chance at survival or recovery. Thus, increases in the absolute number of individuals subject to take each year will be more than compensated for by the elevated overall population levels, and the overall percentage of the population that is subject to take is not expected to increase.

Table 5-1 Summary of Estimated Incidental Mortality of Individuals

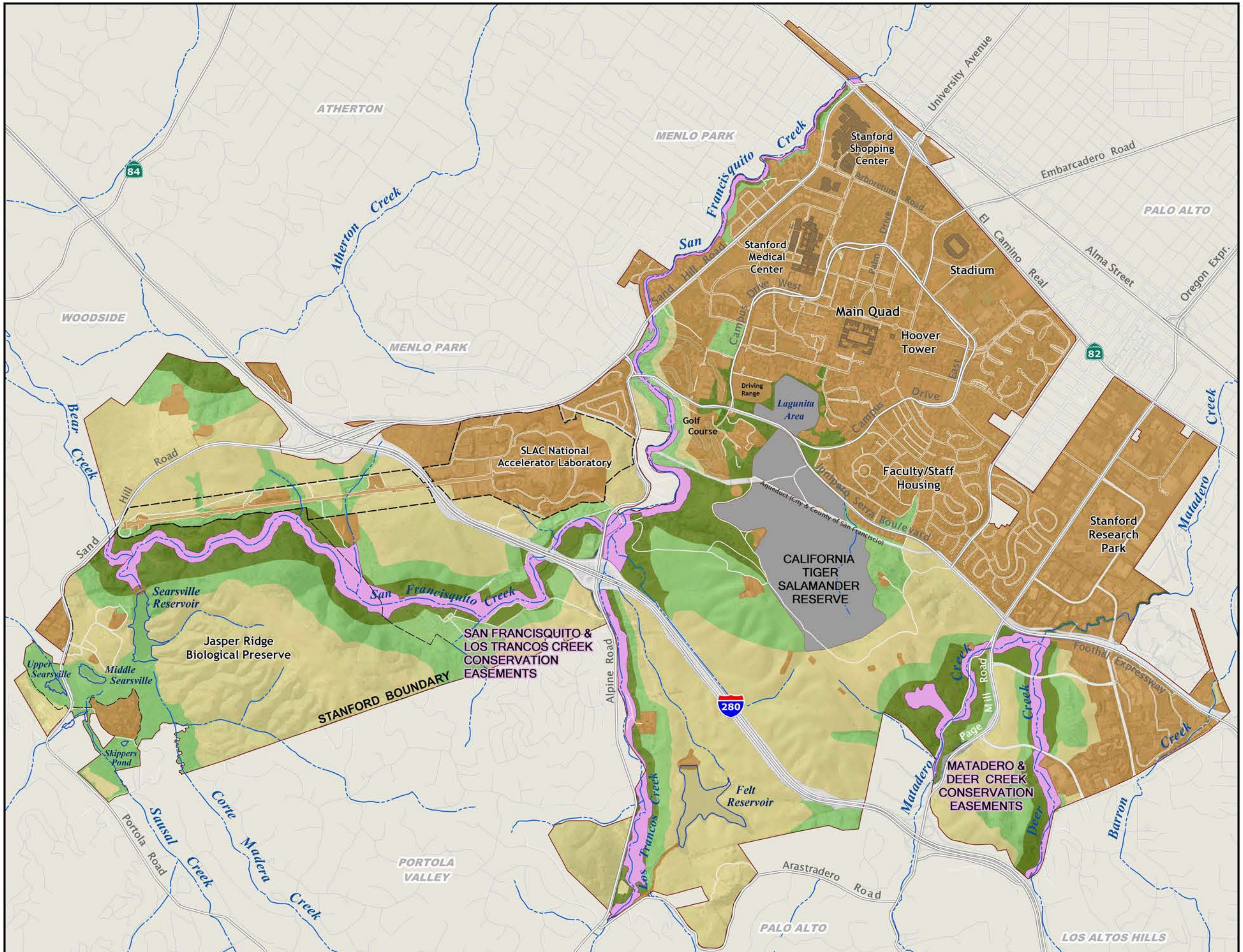
	Estimated annual incidental mortality	Minimum population level	Maximum incidental mortality (percent)	Maximum population level	Minimum incidental mortality (percent)
California red-legged frog	3	25	12 percent	250	1 percent
Juvenile steelhead	120	1,500	8 percent	9,000	1 percent
California tiger salamander	20	400	5 percent	4,000	1 percent
Western pond turtle	0	10	0 percent	40	0 percent
Garter snake	0	20	0 percent	100	0 percent
Population estimates are based on studies conducted at Stanford: 1992 to present (most variation is based on annual fluctuations)					

Table 5-2 Summary Estimated Loss of Zone 1 and 2 Habitat

	Annual estimated short-term habitat disruption	Total estimated short-term habitat disruption	Annual estimated permanent loss of habitat	Total estimated permanent loss of habitat
California red-legged frog	2.0 acres	100 acres	0.6 acres	30 acres
Steelhead[2]	600 feet (max. in one year)	15,000 feet	40 feet	2,000 feet
California tiger salamander	2.0 acres	100 acres	1.4 acres	68 acres
Western Pond turtle	1.6 acres	80 acres	0.3 acres	15 acres
Garter snake	4.0 acres[3]	200 acres	1.9 acres	98 acres
Permanent loss of habitat totals are not identical to the values shown in Table 4-1 because some of the habitat is shared by multiple species and some permanent loss of habitat is associated with Covered Activities other than future development, such as maintenance of existing utilities.				

[2] The steelhead numbers represent temporary and permanent habitat loss only within the creek channels.

[3] In addition, there would be approximately 76 acres of grassland that would be mowed each year for fire break and CTS conservation purposes.



Stanford University Habitat Conservation Plan

Possible Location of Assumed Development

- Zone 1, 20-30 acreas could be developed within zone
- Zone 2, 25-45 acres could be developed within zone
- Zone 3, 35-105 acres could be developed within zone

No Build Areas

- CTS No Build areas for term of HCP
- Conservation Easement

Note: Assumed development cannot occur in either the CTS No Build areas or the Conservation Easements

hectare

100

15

5

acres

Sources:
HCP Zones: Stanford University Campus Biologist, 2006
Aerial photos: Aerotopia, 1999
Creeks: US Geological Survey, 1991

Disclaimer:
This map was produced by the SU Planning Office. While generally accurate, this map may not be completely free of error. The information is derived from a variety of sources deemed reliable, but subject to recurrent change and Stanford does not warrant the accuracy and completeness of these data.

Graphic Scale
1 Inch = 0.5 Miles

0 0.25 0.5 0.75 1
Miles

Stanford University Planning Office
Date Printed: December 2011

Figure 5-1

For example, recent population estimates for California tiger salamanders at Stanford range from 400 to 4,000 adults and juveniles. The Covered Activities are projected to result in the incidental mortality of an average of 20 adult and juvenile tiger salamanders per year. This represents an annual loss of between 1 percent and 5 percent of the current population. If successful implementation of the Conservation Program increases the number of tiger salamanders to 10,000, a loss of 1 percent to 5 percent per year of the increased population would be between 100 and 500 adult and juvenile California tiger salamanders. The significance of this annual loss of 1 percent to 5 percent of the population is reduced as the overall population increases because as populations increase in size, they become less susceptible to the multitude of risks associated with small populations. Therefore, a population's chance of long-term persistence is greatly enhanced when the overall number of individuals increases.

Take generally occurs only in Zones 1 and 2, and Table 5-2 provides a summary of the estimated loss of areas designated Zone 1 and 2. These areas contain habitat for the Covered Species, and are either occupied by the Covered Species or provide the species with habitat that is necessary for their survival, including buffers between occupied habitat and disturbed areas, food sources, and dispersal routes. Zone 3 is comprised of undeveloped open space that benefits the local flora and fauna, including the Covered Species. This benefit, however, is very diffuse and is not linked to any specific population of the Covered Species. Zone 4 includes urbanized areas, and incidental mortality only occurs in Zones 3 or 4 when a species strays from its habitat. [4]

For purposes of this analysis, Stanford estimated the number of Covered Species at Stanford. The population estimates used for this analysis are based on 15 years or more of site-specific work on the Covered Species. However, accurate population estimates are difficult to attain especially when invasive methods are not used. The population estimates in this analysis therefore provide a range of population levels for each of the Covered Species, and the analysis relies on the low end of the range to assess the maximum potential impact to the species. The estimated population levels and potential maximum level of incidental mortality are shown in Table 5-1.

5.3.1 California red-legged frog

The estimated number of California red-legged frogs at Stanford are based on annual surveys conducted since the mid-1990s. These surveys include day and night field activities. While eggs and tadpoles were routinely observed during these field activities, the estimates are for juvenile and adult frogs only. Repeated visits to areas known to support red-legged frogs were used to estimate the number of unseen frogs, which

is based on the likelihood of observing an individual known to be in the area on a specific site-visit. This information, along with precise information on the spatial distribution of sightings, was then used to estimate the number of unseen frogs. In this case, the surveys concluded that for every individual red-legged frog that was observed during the surveys, there were another 2 to 3 individuals in the area. Other methods, most notably toe-clipping or pit-tagging, could yield more quantitatively precise estimates, but gathering data in this manner could cause the take of red-legged frogs. Based on the data available, over the last decade the number of California red-legged frogs at Stanford has ranged from 25 to 250.

Direct Impacts. Agricultural activities, cattle grazing, academic field work, vegetation management, and activities within the riparian areas and creek banks, such as cleaning the water diversion facilities, and bank stabilization, may result in the take of red-legged frogs. In addition to direct harassment, harm, or mortality from these activities, approximately 2 acres per year of red-legged frog habitat will be temporarily disturbed. This disturbance will cause individual red-legged frogs to alter their behavior, which may increase their level of mortality, either by increased risk of predation or by dispersing frogs to inhospitable locations. Although the Minimization Measures will reduce the amount of take associated with the Covered Activities, the Covered Activities could result in the incidental mortality of an average of three frogs per year, and represents 1 to12 percent of the recent population estimates.

Indirect Impacts. Permanent loss of Zone 1 and 2 habitat will reduce the number of California red-legged frogs that Stanford can support. Approximately 30 acres of red-legged frog habitat is anticipated to be lost during the life of the HCP.

Net Effects. During the life of the HCP, the overall red-legged frog population is expected to increase. The Conservation Program, particularly the riparian easements, construction of new off-channel breeding ponds, control of non-native species, and bank stabilization should result in a net increase in the quality of red-legged frog habitat and decrease in mortality rates, which will lead to an increase in the red-legged frog population. As discussed above, an increase

[4] California tiger salamanders are occasionally found in the urbanized areas of the campus. Curbs and other improvements trap the tiger salamanders and prevent them from returning to suitable habitat.

in the species' population will lead to a greater distribution of the red-legged frog at Stanford and greatly reduce the chance of local extinction. It will also lead to an increase in the absolute number of frogs that are harmed or killed. While the number of red-legged frogs subject to incidental mortality may increase, the overall percentage of the population that is impacted will not increase.

5.3.2 Steelhead

Steelhead population estimates are based on field surveys conducted annually since 1997. Summer electrofishing surveys were conducted annually in the late 1990s and early 2000s, and snorkel surveys have been conducted in years with appropriately high water since the early 2000s. These surveys calculated the number of individual juvenile steelhead per 750-foot reach, per mile, and in the entire Stanford portion of Los Trancos, San Francisquito (downstream of Searsville dam), and Bear creeks.[5] Different years frequently yielded different estimates, which were used to develop an estimated range in population level. Rainy season surveys for redds or migrating adults in the San Francisquito watershed were not conducted. Narrow channels, abundant debris, murky water, and very erratic flow rates make working in the creeks during the rainy season dangerous for both researchers and steelhead. Such conditions also reduce the reliability of the data. Based on the best available data, the number of juvenile steelhead annually present during the summer field season at Stanford over the last decade has ranged from 1,500 to 9,000 individuals.

Direct Impacts. Maintenance of the diversion facilities, bridge repairs, creek bank stabilization, and other instream activities that occur from time to time may result in take of steelhead. The instream work typically requires dewatering a short reach of creek and relocating steelhead. Dewatering sections of the creek and handling individual steelhead will unavoidably result in take. In most years, Stanford does not dewater the creek in connection with a Covered Activity. However, the HCP would allow a maximum of 600 feet of creek to be dewatered in a single year. If this occurred, it is estimated that a maximum of 300 juvenile steelhead would be relocated. The maximum annual incidental mortality associated with dewatering activities is estimated to be approximately 10 juvenile individuals.

In addition, conservation program activities such as electrofishing and trapping will result in direct take of steelhead. Annual electrofishing is estimated to collect up to 2,000 juvenile steelhead, and downstream migrant trapping may collect up to an estimated 1,000 juvenile steelhead. All collected fish will be measured and returned to the creek. The incidental mortality associated with these collection activities is estimated to be up to 90 juvenile steelhead.

In addition, the water diversion structures and their operations could result in take of steelhead. While this take has not been observed, and the population has continued to thrive in the existing environment, it is possible that diversions and operations could strand steelhead, increase rate of predation, or inhibit dispersal. It is estimated that the diversion operations with the SHEP operating protocols could result in the annual incidental mortality of 20 juvenile steelhead. Incidental mortality associated with maintenance of these diversion facilities is included in the estimates associated with dewatering described above.

Indirect Impacts. Approximately 7 acres of Zone 1 and 2 riparian or adjacent upland habitat will be developed during the life of the HCP.[6] Of this amount, up to 2,000 feet of creek channel habitat could be lost to bank stabilization and/or infrastructure maintenance/improvements. Other indirect impacts to steelhead include water diversions at the Los Trancos diversion facility and San Francisquito Creek pump station that occur during the winter and spring, which reduce the suitability of habitat for steelhead migration and spawning. The Covered Activities will not result in the adverse modification of steelhead Critical Habitat. Except for some existing utility and transportation facilities, all of Stanford's portion of the steelhead Critical Habitat will be protected under a permanent conservation easement, which will limit activities in the easement area.

Net Effects. Some of the Covered Activities that will result in the take of steelhead also will benefit steelhead. For ex-

[5] The steelhead surveys do not include information on migratory adults, eggs, alevin, or small fry because these life history stages are absent during the summer field season. There are no estimates, therefore, on the impacts of Covered Activities on any of these life history stages. However, the vast majority of potential impacts by Stanford occur in the dry season, during the period when reasonable population estimates are available.

[6] The 7 acres is included in the estimated acreage lost for red-legged frogs and western pond turtle. The total amount of habitat for steelhead, red-legged frogs, and western pond turtles is 30 acres, and the majority of this habitat is Zone 2 upland red-legged frog habitat.

ample, monitoring activities will result in incidental mortality but will provide information important to the conservation of the species. Overall, the HCP will improve and protect steelhead habitat, and likely increase the population of steelhead at Stanford.

5.3.3 California tiger salamander

Although Stanford has conducted rainy night surveys for nearly 2 decades, it is difficult to estimate the number of tiger salamanders at Stanford. California tiger salamanders have a secretive nature, and the landscape at Stanford is a complex mix of urban facilities, roads, and undeveloped academic lands. The presence of a large number of people, including residents, visitors, and college students, renders traditional surveys, which include fencing and pit-fall traps, too difficult to conduct. The wildlife agencies have recommended against toe-clipping and pit-tagging, and Stanford has therefore relied primarily on visual surveys.

Despite these difficulties in surveying for California tiger salamanders, rainy night surveys since the early 1990s have produced an abundance of data on the number of migrating adult and juvenile salamanders. During most years, fewer than 50 salamanders are observed, either as live migrating individuals or as road-kill. During years with appropriately timed fall rains, however, approximately 500 individual salamanders have been observed. Although not all of the populations' adult and juvenile salamanders migrate during these mass migrations, and observers undoubtedly did not encounter every migrating salamander, these mass migrations provide valuable data on the size of the local population. To determine the estimated number of tiger salamanders at Stanford, this analysis assumed that at least 50 percent of adult and juvenile salamanders migrate during mass migrations, and based on the spatial configuration of the campus, concluded that approximately 25 percent of those migrating are observed. Based on these assumptions, Stanford concluded that over the last 15 years, there was a maximum of approximately 4,000 adult and juvenile tiger salamanders at Stanford.

There has not been a mass migration of salamanders at Stanford for nearly a decade. During the past decade, California tiger salamander migration has been much less synchronized, although tiger salamander reproduction has been observed regularly. In these years, the percentage of individuals migrating is well below 50 percent, and salamander migration is not frequently observed. This results in less precise estimates of the population size, and likely leads to an underestimation of the size of the population. Based on the data provided during these years, Stanford estimates that the California tiger salamander population could be as low as 400 individuals.[7]

Direct Impacts. Most of the take will occur because the majority of Stanford's California tiger salamander population breeds in and resides near Lagunita, which is located adjacent to the urbanized portion of the campus. Take of California tiger salamanders may also occur in the foothills south of Junipero Serra Boulevard in areas where there are urban facilities, such as the radio telescope and student observatory or areas where existing utility corridors exist. (The population sinks in the foothills are shown on Figure 2-4). Landscaping, pipe repair, road maintenance, development and redevelopment, and other routine activities needed to operate the University therefore all affect the California tiger salamander. On average, approximately 2 acres of tiger salamander habitat will be temporarily disturbed per year. This short-term disruption of habitat does not result in a permanent reduction of habitat, but may increase the level of mortality for those salamanders that inhabit the disturbed area. The take of tiger salamanders during the course of day-to-day operations has been reduced since the mid-1990s when a range of educational and conservation measures were implemented, and will be further reduced through the implementation of the HCP. However, the Covered Activities could cause the incidental mortality of up to 20 tiger salamanders per year, which is approximately 1 percent to 5 percent of the current tiger salamander population at Stanford.

Indirect Impacts. Approximately 68 acres of Zone 1 and 2 California tiger salamander habitat could be developed during the life of the HCP. As part of the Conservation Program, Stanford is actively creating new tiger salamander breeding habitat south of Junipero Serra Boulevard. The location of these new ponds will allow tiger salamanders to more readily occupy larger portions of the undeveloped foothills. The HCP will create a 315-acre CTS Reserve that will initially include the eight tiger salamander breeding ponds built in 2003. Three of these ponds already support tiger salamander breeding. The Conservation Program will effectively shift the center of the local tiger salamander population from Lagunita, located at the edge of the developed main campus, to the largely undeveloped lower foothills. Thus, the habitat quality of grassland and oak woodland available for upland

[7] Estimates of the tiger salamander population do not include eggs and larvae, which are monitored every year. The Covered Activities generally affect only the adult and juvenile tiger salamanders, and therefore direct effects to the eggs and larvae were not included.

habitat for tiger salamanders will increase if the Conservation Program is successful. However, up to 1.4 acres of upland tiger salamander habitat per year or 68 acres over the duration of the HCP could be permanently lost at Stanford.

Net Effects. Several of the ongoing Covered Activities, including maintenance and operation of Lagunita, mowing, and cattle grazing, benefit California tiger salamanders. Lagunita is an artificial flood control and water storage facility that supports tiger salamander breeding. Mowing the bed of Lagunita for fire control and grazing in the foothills facilitate California tiger salamander dispersal. The implementation of the Conservation Program, which includes a 315–acre CTS Reserve and newly constructed breeding ponds away from developed areas, will substantially increase the quality of tiger salamander habitat at Stanford. Overall, the HCP will have a beneficial effect on the California tiger salamander, and the overall population is expected to increase substantially. As discussed above, an increase in the species' population may result in an increase in the number of individual salamanders that are subject to incidental mortality. However, the overall percentage of the population that is affected (1 to 5 percent of the population) will not increase.

5.3.4 Western pond turtle

The population of western pond turtles at Stanford is currently very low. Surveys from the mid-1990s to the present identified very few turtles, and fewer than ten turtles have been seen since 2000. Records show that there were very few turtles at Stanford during the 1990s; however, there were more turtles at Stanford in the 1990s than there are now. Current estimates are between 10 and 40 western pond turtles at Stanford.

Direct Impacts. Fewer than ten western pond turtles have been found at Stanford during the past 5 years, and the Covered Activities have very little effect on the turtles. Because of the nature of the Covered Activities, and the extremely low existing population of western pond turtles, Stanford will not kill any of the individual turtles. Approximately 1.5 acres of potential turtle habitat will be unavoidably disturbed annually. This disturbance is primarily the result of maintenance of the diversion facilities, bridge repairs, creek bank stabilization, and other instream activities that occur from time to time. Given the scarcity of turtles and the frequency of the Covered Activities, it is not anticipated that these activities will harm or harass the turtles.

Indirect Impacts. Approximately 15 acres of potential western pond turtle habitat is anticipated to be lost during the life of the HCP. The local western pond turtle population is significantly below its carrying capacity and there is more than enough suitable habitat to support any reasonably foreseeable increase in the western pond turtle population. Therefore a slight reduction in this carrying capacity due to the permanent loss of habitat will not affect the turtle.

Net Effects. The implementation of the Conservation Program, particularly the riparian easements and creek maintenance, will improve and expand western pond turtle habitat. However, the population likely will not increase during the life of the HCP, even with the successful implementation of the Conservation Program. The low number of western pond turtles at Stanford is due to several historic factors, including the development of the surrounding communities. Overall, the HCP will improve habitat for the western pond turtle, but this may have little effect on the population.

5.3.5 San Francisco garter snake

Stanford currently supports a small garter snake population. A few individual garter snakes are encountered at Lagunita every year, but specimens from other locations at Stanford are only very infrequently observed. Recent observations indicate that fewer than 100 garter snakes currently live at Stanford. However, the number of garter snakes at Stanford may be increasing, primarily due to recent salamander-related changes in land management (e.g., Lagunita is no longer disced for fire control).

Direct Impacts. Approximately 80 acres of potential garter snake habitat[8] will be unavoidably disturbed annually. This disturbance is primarily the result of dry season vegetation management. However, dry season mowing generally has very little effect on the garter snakes, and since the population density of garter snakes at Stanford is very low, all lethal take of garter snakes will be avoided. These activities may harass any garter snake that happens to be present. By avoiding the lethal take of all garter snakes, Stanford will avoid any potential lethal take of the protected San Francisco garter snake.

Indirect Impacts. Approximately 98 acres of potential garter snake habitat is anticipated to be lost during the life of the HCP. Suitable habitat areas could support a larger garter snake population. Therefore, a slight reduction in the amount of suitable habitat will not have an adverse effect.

Net Effects. The implementation of the Conservation Program, particularly the riparian easements and the Central Campus CTS Management Plan will protect and improve potentially suitable habitat. It is unclear whether the local garter snake population will continue to increase during the life of the HCP, even with the successful implementation of the Conservation Program. The low number of garter snakes at Stanford is due to several historic factors, including the development of the surrounding communities and now discontinued land management practices. Overall, the HCP will improve habitat conditions.

5.4 CUMULATIVE IMPACTS

As described above, the impacts of the Covered Activities were assessed relative to the existing conditions at Stanford. Chapter 3 of the HCP defines the Covered Activities as broadly as possible to encompass a wide variety of University-related activities and future development. Development in the surrounding communities, which is outside the scope of this HCP, may contribute to cumulative impacts on the Covered Species. Thus, other activities and projects in the region that are not covered by this HCP may, in conjunction with this HCP, affect the Covered Species. Specific projects not covered in this HCP that may impact the Covered Species are described below. Additional potential cumulative impacts are described in the EIS for the HCP.

The cumulative impact analysis addresses a relatively local geographic area that includes San Mateo and Santa Clara counties on the San Francisco Peninsula. For purposes of this HCP, the geographic limit for steelhead was expanded to include the Central California Coast Distinct Population Segment.

[8] This habitat is suitable for all local garter snakes, and the effects apply to all local garter snakes at Stanford, whether or not they are considered San Francisco garter snakes.

5.4.1 Steelhead Habitat Enhancement Project (SHEP)

Stanford worked with the CDFG and NOAA Fisheries to develop the Steelhead Habitat Enhancement Project at Los Trancos Creek Diversion Facility, San Francisquito Creek Pump Station and Felt Reservoir (SHEP). This project addresses in-stream structures and diversion from San Francisquito Creek and Los Trancos Creek. The SHEP was developed independently of the HCP, and construction activities were permitted separately. The SHEP facilities were constructed in the summer and fall of 2009, and Stanford's water diversion facilities on Los Trancos and San Francisquito creeks continue to operate as described in the SHEP.

The goals of the SHEP are to enhance fish passage conditions at the in-stream structures and to reduce diversion without adversely impacting Stanford's water supply. The SHEP includes:

- Physical modifications at the Los Trancos Diversion/Ladder Facility;
- Operational modifications at the Los Trancos Fish ladder diversion facility;
- Physical modifications at the San Francisquito Creek Pump Station;
- Operational modifications at the San Francisquito Creek Pump Station.

(See Appendix A for a project description in the Biological Opinion and the Streambed Alteration Agreement). The SHEP will improve steelhead habitat and decrease the incidental mortality of steelhead associated with the diversion facilities.

5.4.2 The San Francisquito Creek Bank Stabilization and Revegetation Master Plan

Another project related to habitat in San Francisquito Creek is a master plan developed by the Santa Clara Valley Water District (SCVWD) to address bank stabilization and revegetation. The master plan defines the range of bank stabilization and revegetation techniques that are most appropriate for San Francisquito Creek and describes them at a conceptual level. The primary goal of the master plan is to develop stabilization methods for eroding banks that allow vegetation establishment for habitat development, streamside shading, and fisheries enhancement.

The master plan describes steps involved in planning habitat restoration that may or may not follow bank stabilization attempts, such as vegetation restoration and fisheries and wildlife protection and enhancement guidelines. These guidelines aim to reduce the level of bank erosion and failure along the lower reaches of the creek while also restoring the riparian corridor to a more native plant assemblage.

The master plan should improve San Francisquito Creek's riparian habitat for steelhead, red-legged frogs, garter snakes, and western pond turtles. The conservation activities proposed in the master plan may result in some take. However, improving habitat outside of Stanford, in conjunction with Stanford's conservation efforts, will improve habitat for these species.

5.4.3 San Francisquito Creek Study

The U. S. Army Corps of Engineers (USACE) and San Francisquito Creek JPA initiated a Feasibility Study in April 2006 that is intended to identify and evaluate ways to alleviate flooding, address environmental degradation, and identify recreational opportunities in the San Francisquito Creek watershed. The USACE anticipates that the feasibility study will take approximately 7 years to complete and any project selected for implementation will require Congressional approval and further NEPA review. The Notice of Intent (NOI) for the Feasibility Study identified several potential alternatives that could affect Stanford lands, including the construction of new detention basins, modifications to Searsville Dam, or the removal of Searsville Dam. These were just a few of several potentially viable alternatives identified in the NOI. At this time, the Feasibility Study has not identified a preferred alternative or even determined whether any of the alternatives identified in the NOI are feasible.

Any modifications to Searsville Dam or San Francisquito Creek could affect steelhead, red-legged frogs, garter snakes, and western pond turtles. However, the effects on these species are currently unknown, because no specific improvements have been identified. Before any flood control actions are taken, they would be subject to review under NEPA, at which time the direct, indirect, and cumulative effects of the project would be addressed.

5.4.4 Santa Clara Valley Draft HCP/NCCP

The Santa Clara Valley HCP/NCCP is a regional partnership between the County of Santa Clara; Santa Clara Valley Transportation Authority; Santa Clara Valley Water District; the cities of San Jose, Gilroy and Morgan Hill; the CDFG; and the Service. The HCP/NCCP will cover approximately 520,000 acres in southern Santa Clara County, and will address the California tiger salamander, California red-legged frog, western pond turtle, western burrowing owl, Bay checkerspot butterfly, and other plant and animal species. The draft HCP/NCCP identifies a broad range of activities, including urban development, major capital improvements, and instream operations, maintenance, and projects. The draft finds that the Covered Activities will result in the take of the Covered Species and in habitat loss and degradation. However, the draft also includes a conservation strategy that recommends preserving approximately 45,000 acres of habitat. Thus, the Santa Clara Valley HCP/NCCP in conjunction with the Stanford HCP should provide regional protection for the Covered Species.

5.4.5 Urban Growth

Future non-Stanford development in San Mateo and Santa Clara counties will continue during the life of the HCP. Continued development will have a cumulative effect on all of the Covered Species. For example, the loss of wetlands in Santa Clara County from future development will reduce breeding habitat for the California tiger salamander, storm water runoff from urban landscapes in both counties that includes pesticides and human use of creek habitats for recreation alter California red-legged frog, steelhead, and western pond turtle habitat. Recreational trails in upland areas can degrade California red-legged frog and California tiger salamander habitat. Urban development outside Stanford, coupled with Stanford's future development, will reduce the amount of existing habitat for the Covered Species. Some or all of these losses may be offset by mitigation. However, it is unknown at this time whether mitigation will make up for the lost functions and values of the existing habitat. Therefore, the precise impact of cumulative future growth is unknown.

5.4.6 Ongoing and Routine Agriculture

Ongoing and routine agricultural activities off of Stanford lands may have some cumulative impacts on the Covered Species. Ongoing grazing may limit or degrade riparian habitat for the western pond turtle, California red-legged frog, and steelhead. Unregulated grazing can also degrade upland habitat for the California tiger salamander, garter snakes, and California red-legged frog, and individuals may be trampled by cattle. Since the impacts of ongoing and routine agriculture are generally unregulated, and mitigation is therefore not required for impacts associated with these activities, some adverse effects on the Covered Species is expected. However, the precise impacts of ongoing and routine agriculture, and their cumulative effects, are unknown.

SECTION 6
PLAN IMPLEMENTATION

6.0 PLAN IMPLEMENTATION

Section 6.0 describes how the HCP will be implemented and the persons and entities responsible for its implementation.

6.1 PLAN PARTICIPANTS

6.1.1 Stanford University — Permittee

Stanford University has been in existence for nearly 120 years, which is longer than many Bay Area cities, and consistent with the Founding Grant, intends to be a permanent academic institution. Over the last century, a city-sized academic campus has been established on Stanford lands, as well as several commercial and retail businesses that financially support the University. The campus also includes thousands of acres of open space lands, some of which are leased for agriculture, horticulture, grazing, and equestrian uses.

6.1.2 Subpermittees

Much of the land south of Junipero Serra Boulevard and areas within San Mateo County are leased for agricultural and equestrian related uses.[1] These are considered interim uses to generate income for the University, while preserving these lands for future academic uses. Most of the agricultural leases are short-term and can be terminated annually, although some of the leases are for longer terms. The HCP will regulate some of the lease holders' activities, and Stanford, through the Conservation Program Manager, will require the lease holders' compliance with the terms of the HCP and related permits. The lease holders will be covered by the incidental take permits, and Stanford may issue Certificates of Inclusion making the lease holders subpermittees under the HCP.

Several entities, including Pacific Gas and Electric Company (PG&E), the San Francisco Public Utilities Commission (SFPUC), the Santa Clara Valley Water District (SCVWD), and the San Francisquito Creek Joint Powers Authority (JPA) own or operate utilities and other facilities located throughout the University. These facilities provide Stanford and the surrounding community with public utility, and other, services. Operation and maintenance of these facilities may be covered by the incidental take permits through Certificates of Inclusion, and Stanford may issue a Certificate of Inclusion to any entity that owns or operates facilities on Stanford's lands if the entity agrees to comply with the terms of the HCP and related permits. These entities would be considered subpermittees under the HCP.

Stanford will be responsible for requiring the subpermittees' compliance with the HCP, take permits, Implementing Agreement (IA), and Certificates of Inclusion. Stanford, as a condition of the Certificates of Inclusion and any future leases, will require the subpermittees to take remedial measures in the event the terms of the HCP, Certificates of Inclusion, incidental take permits, or IA are not adhered to by a subpermittee. Stanford, as the primary permittee under the incidental take permits, will be responsible for ensuring any and all necessary remedial measures are taken, and will undertake any required remedial measures if the subpermittees fail to do so.

[1] The 12 agricultural and equestrian leases comprise approximately 2,200 acres in the following categories: six horse boarding facilities, one nursery, one vineyard, and four multiple-use ranches that include cattle grazing.

6.1.3 Wildlife Agencies

The Service and NOAA Fisheries have the authority to issue Section 10(a)(1)(B) incidental take permits under the ESA and are responsible for enforcing the provisions of the HCP and all permits issued under the HCP subject to Stanford's responsibility for enforcing the provisions of the HCP, permits, and IA against its lease holders, and for reviewing annual status reports and responding to requests for amendments. The Service has jurisdiction over terrestrial species and resident aquatic species, and NOAA Fisheries has jurisdiction over migratory aquatic species, such as steelhead. The Service and NOAA Fisheries also will maintain and provide information regarding current survey protocols.

Once the wildlife agencies have issued an incidental take permit, primary responsibility for implementing the HCP will rest with Stanford. However, the wildlife agencies will receive reports concerning the HCP's implementation and they will provide input on Stanford's implementation of the HCP's conservation program, and guidance on how to respond to changed circumstances (described below).

6.2 TERM OF PERMIT

Stanford is seeking incidental take permits from the Service and NOAA Fisheries with terms of 50 years. The incidental take permits issued under Section 10(a)(1)(B) of the ESA and the associated HCP would each be in effect for a period of 50 years from the date of issuance of the permits. Upon expiration of the incidental take permits, Stanford will not have take authorization under the ESA. However, prior to permit expiration, Stanford may apply to renew the incidental take permits and associated HCP, and rollover its unused credits. Stanford anticipates that it may seek renewals of up to 10 years, subject to mutual review and agreement by the parties. To give the parties adequate time to review and process permit renewals, the parties will initiate the permit renewal review 5 years prior to the expiration of the initial 50-year period, and 1 year prior to the expiration of any renewal.

In choosing an appropriate permit term, Stanford considered several factors consistent with the "five-point policy" described in Section 1.2.3, including the duration of the covered activities, the effects to species, and the relationship between the permit duration and the HCP's conservation program. Fifty years was chosen as the permit duration because it is a reasonable timeframe for Stanford to forecast its operational and infrastructure needs, as well as to anticipate future development that could affect Covered Species habitat. As discussed in Section 1.1, Stanford has more than 120 years of hindsight and experience in operating the University, and forecasting its future needs. Many of Stanford's operational, maintenance, and academic activities have changed very little during this time, and will continue for at least the next 50 years. Major infrastructure, such as domestic water pipelines, roads, and bridges, are relatively permanent, and the maintenance and operation of these facilities does not typically change over time. Likewise, Stanford will have to continue to engage in fire and public safety actions, such as maintaining fire breaks and removing debris from the creeks that could result in flooding of urbanized areas. The 50-year timeframe is also expected to be necessary to use up the credits that Stanford will earn from its initial preservation of 360 acres of habitat and other habitat enhancements. A 50-year time frame also provides a reasonable conservation planning horizon, and will allow Stanford to achieve important conservation measures, particularly the goal of stabilizing its tiger salamander population by reducing the tiger salamander's reliance on Lagunita and transitioning the population to more appropriate, newly created habitat in the foothills.

6.3 ESTABLISHMENT OF IMPLEMENTATION ENTITIES

6.3.1 HCP Authorities and Responsibilities

The University's Board of Trustees (BoT) establishes land use policy and will ultimately approve the HCP and authorize the President or Vice President for Land Buildings and Real Estate (VPLB&RE) to apply for an incidental take permit from the Service and NOAA Fisheries, to sign agreements implementing the HCP, and grant the permanent conservation easements described in Section 4.3 of the HCP. Likewise, the VPLB&RE will obtain funding from the University to implement the HCP, and when the BoT approves the HCP, it will commit to authorize annual funding for the HCP.

When the BoT approves the HCP, Stanford will establish an HCP Conservation Program Manager position to oversee the day-to-day implementation of the HCP. The Conservation Program Manager will also communicate directly with the Service and NOAA Fisheries as needed. More information about the Conservation Program Manager position is provided in Section 6.3.2, below.

A separate, non-profit land trust organization will be formed pursuant to Section 815 of the California Civil Code to hold the San Francisquito/Los Trancos Easement, Matadero/Deer Easement and any subsequent conservation easements granted in accordance with Section 4.3 of the HCP. More information about the land trust is provided in Section 6.3.3, below.

6.3.2 Conservation Program Manager

As described above, Stanford will create and fund a Conservation Program Manager position for the life of this HCP. The Conservation Program Manager will have the day-to-day implementation responsibilities for Stanford University's HCP. Generally, these responsibilities fall into five areas.

Minimizing Impacts from Ongoing Operations

The conservation program described in Section 4.0 identifies many minimization measures that require involvement by the Conservation Program Manager. Generally, these measures have the following requirements for the Conservation Program Manager:

- Develop a protocol for submission of any plans or activities that require consultation with or review by the Conservation Program Manager,
- Review various ground-disturbing activities in Zones 1 and 2,
- Assess habitat value, and
- Identify design or operation alterations to reduce the potentially adverse effects of the Covered Activities on the Covered Species.

In addition, the Conservation Program Manager will be consulted when existing operations require relocation, so that such relocation can be beneficial to the Covered Species.

Input on University's Future Development

Many factors are considered when the University sites a new academic facility. The most important factor is the intended use of the building and its relationship to other buildings. In a university setting, the adjacency of related buildings can greatly affect the success of programs housed within those buildings. Once several potentially suitable sites have been identified, other factors such as existing infrastructure, environmental impacts, and cost are used to select the final site.

The Conservation Program Manager will be involved in the University's site selection process, identifying potential impacts to the Covered Species at each of the alternative sites. If the University selects a site that would result in loss of habitat in Zones 1, 2, or 3, the Conservation Program Manager will identify the mitigation requirements of the development (e.g., how many mitigation credits would need to be deducted from which account, and whether Stanford would have to earn more credits to offset the impacts).

Coordination with Wildlife Agencies

Stanford will seek guidance from the Service and NOAA

Fisheries regarding the implementation of the HCP. The Conservation Program Manager will seek guidance from the wildlife agencies regarding:

- The location of future conservation easement areas;
- Habitat enhancements;
- Potential fish passage improvements at Searsville Dam if a major modification of the dam is proposed;
- The design of any new bridges spanning San Francisquito or Los Trancos creeks;
- Any bank stabilization structures;
- Appropriate remedial or restoration efforts to address changed circumstances;
- Methods for addressing invasive species if current methods prove ineffective;
- The cause of any downward species population trends that are inconsistent with normal population variations and appropriate adaptive management techniques;
- Other changes to the conservation program made as a result of the adaptive management process.

In addition, Stanford will provide the Service and NOAA Fisheries with a copy of all applications, including preconstruction notifications (PCN), that Stanford submits to the Department of the Army, U.S. Army Corps of Engineers (Corps) pursuant to Section 404 of the Clean Water Act. Stanford will transmit a copy of the application/PCN to the Service and NOAA Fisheries within 3 days of submitting it to the Corps. When Stanford transmits the Section 404 permit application/PCN to the Service and NOAA Fisheries, Stanford will also identify the applicable HCP Covered Activity and the associated minimization and mitigation measures for the Service and NOAA Fisheries.

General Biological Activities

In addition, the Conservation Program Manager will have general biological responsibilities, which include:

- Coordinate and review biological enhancement activities;
- Coordinate the management and monitoring activities described in this HCP;
- Collect and analyze data gathered during the implementation of this HCP;
- Coordinate the adaptive management and biological monitoring efforts described in this HCP;
- Keep abreast of current scientific methods and concepts;
- Communicate with other scientists at Stanford and external scientists, including wildlife agency staff.

Administrative Activities

The Conservation Program Manager will be responsible for the ongoing administrative tasks that will be required in order to implement the HCP. They include:

- Coordinate implementation of the HCP;
- Coordinate the preparation and submission of the Annual Report (Section 6.4) to the Service and NOAA Fisheries;
- Develop an annual budget to ensure adequate funding on an annual basis;
- Monitor compliance with the HCP and any plans or programs that are developed under the HCP; and
- Develop, review, and approve, as required, all plans or programs Stanford or its lease holders are required to develop under the Conservation Program.

To ensure the Conservation Program Manager is qualified for the position and able to effectively implement this HCP, the person holding this position will have been awarded no less than a Masters of Science in a field related to conservation biology, and will be familiar with the habitat needs of the Covered Species. Other biologists and staff may assist the Conservation Program Manager in carrying out the activities that the Conservation Program Manager is responsible for under this HCP. The Conservation Program Manager and other biologists that might handle Covered Species will comply with the appropriate federal and state regulations.

6.3.3 Entity to Hold Conservation Easements (Land Trust)

Stanford will be responsible for implementing the HCP, including the implementation of the Matadero/Deer Easement Monitoring and Management Plan, San Francisquito/Los Trancos Easement Monitoring and Management Plan, CTS Reserve Monitoring and Management Plan, Central Campus CTS Monitoring and Management Plan, and any subsequent perpetual monitoring and management plans. As described above, Stanford will form a non-profit land trust organization that is qualified under Section 815 of the California Civil Code to hold the conservation easements that the University will grant in accordance with Section 4.3 of the HCP.

The land trust will consist of a board of directors, with no less than five and no more than seven directors; and a non-voting ex officio member of the board who will provide administrative support to the board of directors. At least two members of the board of directors will be selected from the public at large. The public-at-large members will be individuals who are or have been associated with environmental organizations focused on habitat, species, and land conservation purposes (for example, the Peninsula Open Space Trust, the California Council of Land Trusts, the California Nature Conservancy, and others). The President of Stanford will appoint the initial board of directors to a 2-year term. Future members of the board of directors will be selected as follows: The two public-at-large members will be selected by the board, and Stanford's President will appoint the remaining members of the board of directors.

The permanent conservation easements that Stanford grants pursuant to this HCP will give the land trust the right to enforce the terms and conditions of the conservation easement deeds (and these terms and conditions shall be reviewed and approved by the Service and/or NOAA Fisheries prior to recordation) and the HCP's Monitoring and Management Plans. The Service and NOAA Fisheries will be third-party beneficiaries of the conservation easements. As third-party beneficiaries, they also will be able to enforce the terms of the conservation easements.

In addition to holding the conservation easement deeds, the land trust will monitor Stanford's compliance with the HCP's Monitoring and Management Plans and the terms of the conservation easement deeds granted pursuant to the HCP. During the term of the HCP and associated permits, the Service and NOAA Fisheries will have primary responsibility for determining whether Stanford is complying with the terms of the HCP and the conservation easement deeds dedicated pursuant to the HCP. If Stanford is not in compliance, the Service and NOAA Fisheries will have the authority to suspend, revoke, and enforce the terms of the HCP and the associated permits in accordance with the IA and federal law. As such, if, during the term of the HCP and permits, the land trust determines that Stanford is not in compliance with the conservation easement deed or the HCP's Monitoring and Management Plans and the Service or NOAA Fisheries finds that Stanford is in compliance, the finding by the Service or NOAA Fisheries will prevail and the land trust will have no further recourse against Stanford or the Service and NOAA Fisheries, except as otherwise provided for in the conservation easement deeds. Following the expiration of the HCP and permits, the land trust entity will have primary responsibility for enforcing the terms of the conservation easements and the associated long-term monitoring and management plans, and the land trust will have the authority to legally enforce the terms of the easements. As third-party beneficiaries of the conservation easement deeds, the Service and NOAA Fisheries also will have the ability to enforce the terms and conditions of the conservation easement deeds after the permits expire.

Stanford will provide the land trust with copies of the Annual Report described in Section 6.4. In addition, the Conservation Program Manager will provide the board of directors for the land trust with a mid-year written status report. This report will be provided to the board of directors at a regularly scheduled meeting, and will describe (i) the land conservation, monitoring, management, enhancement or other actions that have occurred within the easement areas since the most recently submitted Annual Report; (ii) monitoring, management, enhancement or other actions Stanford plans to take before the end of the annual reporting period; and (iii) Stanford's plans to conserve additional lands. At least once a year, Stanford will give the land trust the opportunity to visit the easement areas and thoroughly monitor compliance with the terms of the easement deeds.

6.4 ANNUAL REPORTING

Every year beginning after the first full year of the HCP's implementation, Stanford will submit an Annual Report to the Service and NOAA Fisheries that documents permit compliance (including impacts, land preservation and enhancements, and studies), management actions, monitoring results, and any changed or unforeseen circumstances that occurred. Annual Reports will include synthesis of data and reporting on important trends such as changes in habitat conditions[2] and the distribution and abundance of the Covered Species. The Annual Report will describe any enhancements planned for the upcoming year, any plans Stanford has to preserve additional land during the upcoming year,[3] any anticipated changes in management techniques that Stanford plans to make and an explanation of why those changes are needed, confirmation that funding has been committed for the next year, and disclose any difficulties Stanford encountered in implementing the HCP.

The Annual Report is due on October 1, or the first business day in October if the first day of the month falls on a non-business day, each calendar year, or portion of a calendar year, during which the permits will be in effect. If Stanford cannot provide the Annual Report by the first business day in October, it can request an extension. The Service and NOAA Fisheries will provide Stanford with comments on the Annual Report within 60 days of receipt of the report. If either agency cannot respond within the 60-day period, it can request an extension. At the end of the comment period, Stanford and the wildlife agencies will confer about any comments the agencies have about the report. Stanford will incorporate, to the extent feasible, agency comments into the Annual Report at the time they are received.

Every 5 years Stanford will prepare an overview report that describes trends in species' distribution and abundance, and habitat quality. The 5-year report will synthesize data provided

[2] For example, drought conditions could result in habitat changes, and any actions taken in response to drought conditions will be described in the Annual Report.

[3] Stanford may, at any time, preserve additional lands or make habitat enhancements even if the preservation or enhancement was not anticipated by the Annual Report.

in the previous Annual Reports (and any relevant data from the previous biological monitoring results that was not specifically included in an Annual Report) and include data about regional changes, such as climate change, flood control activities, urban development, major wildfires, floods, and droughts, that have affected the Covered Species.

The third 5-year report (i.e., 15 years after permit issuance) also will report on the status of Searsville Dam if no fish passage around Searsville Dam has been made pursuant to Section 4.2.1. The report will address potential opportunities during the remainder of the HCP to improve fish passage.

6.4.1 Accounting of Mitigation Land

The HCP establishes the San Francisquito/Los Trancos Riparian Account, Matadero/Deer Riparian Account, and CTS Account to account for the benefits to the Covered Species. The Riparian Accounts will initially be "funded" by the preservation of large portions of land that provide habitat for the Covered Species (Section 4.3). The Conservation Program includes measures to ensure the San Francisquito/Los Trancos Easement, Matadero/Deer Easement and CTS Reserve are established in a timely fashion, and to ensure that Stanford always maintains a sufficient number of credits in the San Francisquito/Los Trancos Riparian Account, Matadero/Deer Riparian Account, and CTS Account. (The CTS Reserve and easements are referred to collectively in this Chapter as the Preserved Areas.)

In the Annual Report, Stanford will include an accounting of all lands contained within habitat Zones 1 through 3 that have been subject to permanent conversion along with the acreage, location, and management status of lands required to be set aside as mitigation for the conversion. Specifically the report will include:

(1) Conversion: The annual incremental and cumulative area converted to urban development in Zones 1, 2, and 3.

(2) Mitigation: The annual incremental and cumulative area of mitigation lands preserved, and a description of which of the lands constitute Zones 1 and 2 habitats.

(3) Net Acreage: The overall acreage of preserved land and a breakdown of acreage in the:

- i. San Francisquito/Los Trancos Easement
- ii. Matadero/Deer Easement
- iii. CTS Reserve
- iv. Other or newly created easement or preservation area

(4) Net Credits: The annual incremental and cumulative number of credits in the accounts, and an explanation of how any new credits were earned (e.g., by land preservation or enhancement activity as defined by Table 4-2). This will include a breakdown of the current number of credits in the:

- i. San Francisquito/Los Trancos Riparian Account
- ii. Matadero/Deer Riparian Account
- iii. CTS Account
- iv. Other or newly created account

6.5 FUNDING ASSURANCES

Stanford is responsible for ongoing habitat conservation, monitoring, and management as described in the HCP for the life of the permits. Stanford University is financially solid and derives income from rents, financial investments, tuitions, and private contributions. Stanford has sufficient revenue to cover the cost of implementing the measures proposed in the HCP. By resolution, Stanford's Board of Trustees will approve the HCP and the IA, which will bind the University to carrying out the terms and conditions and funding requirements of the HCP.

Under the HCP, Stanford will manage 675 acres of habitat within the Preserved Areas, and an additional 95 acres will be managed under the Central Campus CTS Management Plan. In addition, Stanford may preserve and manage additional habitat for the benefit of the Covered Species during the life of the HCP. Implementation costs for the central campus area and Preserved Areas, and additional habitat enhancements for the Covered Species are estimated to be $500,000 - $600,000 per year. These estimates were derived from a review of current open space and habitat management expenditures in other comparable areas, and include:

- Salary for the Conservation Program Manager and other support staff;
- Field work staff, including graduate students and consultants;
- Support equipment such as vehicles and storage facilities;
- Enhancement projects such as new ponds or restoration, with budgets likely accrued annually and conducted periodically;
- Ongoing management of the Preserved Areas that includes non-native species management and removal; and
- Monitoring and preparation of annual reports.

Land acquisition costs are unnecessary because Stanford owns the land that is included in the HCP. As a result, the annual funded amount identified above also does not include the fair market value of the land permanently dedicated to conservation.

Based on these cost estimates, Stanford will commit to including a line item for HCP implementation into its annual operating budget for the life of the HCP. That budget item will be sufficient for all aspects of the HCP implementation including funding of the Conservation Program Manager position (or a similar entity responsible for Plan implementation).

In accordance with the Conservation Program, Stanford will prepare long-term monitoring and management plans for the habitat that is protected through a conservation easement deed pursuant to the HCP. These monitoring and management plans, which will be subject to review and approval by the Service and NOAA Fisheries, will survive the expiration of the incidental take permits and this HCP, and Stanford will be responsible for ensuring that the long-term easement-related management and monitoring actions are funded after the HCP and associated incidental take permits expire. Funding for these future monitoring and management actions will therefore also be addressed in each of the long-term monitoring and management plans.

6.6 CHANGED AND UNFORESEEN CIRCUMSTANCES

Federal regulations define the concepts of "changed and unforeseen circumstances" and describe potential future responsibilities based on whether changes in circumstances could have reasonably been foreseen and whether they have been addressed by the HCP. This section of the HCP addresses changed and unforeseen circumstances in accordance with the regulations.

Generally, a changed circumstance is a change in the circumstances affecting a Covered Species that can be reasonably anticipated, which allows a plan to be developed in advance to accommodate the change. Changed circumstances include relatively predictable, but unplanned events, such as fires, flooding, and other natural occurrences such as an invasion of pests or non-native plants. It also includes occurrences such as an illegal or accidental spill of toxic materials. The wildlife agencies are required to ensure changed circumstances are identified and planned for in the HCP. Anticipating and addressing these changed circumstances adds to the conservation value of the HCP by reducing the potential risks associated with the changed circumstance. It also provides the agencies with additional assurance that Stanford will take certain actions if such an event occurs, and it gives Stanford the assurance that it will not be held accountable to fully compensate for impacts of natural events or events that are outside of its control. Changed circumstances are identified and addressed in Section 6.6.2.

In the event that a Preserved Area is threatened by fire, flood, or similar emergency, the HCP will not prohibit access by emergency response personnel, and all emergency personnel shall have access to the Preserved Areas. In the event that disturbance of a Preserved Area is necessary to protect life or to prevent the catastrophic loss of property, emergency personnel shall, where time permits, attempt to contact the Service and/or NOAA Fisheries for input on how best to respond to the emergency to maximize preservation of plant, fish, and wildlife values while preserving life and preventing the catastrophic loss of property. If time does not permit such consultation, Stanford is authorized to permit emergency personnel to disturb the Preserved Areas as necessary to preserve life and prevent the catastrophic loss of property.

After the emergency relief process begins, Stanford will meet and consult with the Service and/or NOAA Fisheries in accordance with Sections 6.6.1 and 6.6.2 below to determine the need for and schedule for rehabilitating the Preserved Area(s).

Unforeseen circumstances, on the other hand, are events that could not be reasonably anticipated during the development of the HCP and response measures are therefore not included in the HCP. Unforeseen circumstances are addressed under the "No Surprises" rule, which is described in Section 6.6.1, below.

The difference between an unforeseen and a changed circumstance may depend upon the severity of the event. For example, a flooding event up to a 100-year event may qualify as changed circumstances whereas an even larger storm would be an unforeseen circumstance. Likewise, a small fire that affects only a few or tens of acres could be a changed circumstance, but a large fire that destroys hundreds or thousands of acres, would be considered unforeseen. To the extent practicable, the difference between a changed and unforeseen circumstance is identified.

6.6.1 Unforeseen Circumstances

Unforeseen circumstances are events affecting a species or geographic area covered by the HCP that could not reasonably have been anticipated by the participants during the development of the HCP, and that result in a substantial and adverse change in the status of a Covered Species.

If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, the Service or NOAA Fisheries may require additional measures where the HCP is being properly implemented; but, such additional measures are limited to modifications within the Easement Areas or to the Conservation Program for the affected species. The original terms of the HCP will be maintained to the maximum extent possible.

Additional conservation and mitigation measures will not involve the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the HCP without Stanford's consent. 50 CFR 17.22(b)(5)(iii)(B)(C), and 50 CFR 222.308(g)(3).

The Service and NOAA Fisheries will have the burden of demonstrating that unforeseen circumstances exist, using the best scientific and commercial data available. A finding of unforeseen circumstances must be clearly documented considering certain specific factors.[4] If such a finding is made and additional measures are required, Stanford will work with the Service and/or NOAA Fisheries to appropriately redirect resources to address the unforeseen circumstances.

No Surprises Rule. The No Surprises rule (50 CFR Part 17, 1998) provides that once an incidental take permit has been issued pursuant to an HCP, and its terms and conditions are being fully implemented, the federal government will not require additional conservation or mitigation measures, including land, water, money, or restrictions on land.[5] If the status of a species addressed under an HCP unexpectedly declines, the primary obligation for undertaking additional conservation measures rests with the federal government, other government agencies, or other non-federal landowners who have not yet developed an HCP.

6.6.2 Changed Circumstances

The term "changed circumstances" is defined by the regulations as "changes in circumstances affecting a species or geographic area covered by a conservation plan that can reasonably be anticipated by plan developers and the [Service /NOAA Fisheries] and that can be planned for (e.g., the listing of a new species, or a fire or other natural catastrophic event in areas prone to such events)." Natural phenomena such as wildfires, floods, and prolonged drought, which depend to a large extent on Stanford's location and the history of such events in the region, and the listing of new species, were identified by Stanford and the agencies as the most relevant changed circumstances. In addition, the HCP identifies other, less likely occurrences such as invasive pests and toxic contamination.

Fire. Certain areas of Stanford contain highly flammable vegetation, and although fire management will reduce the risk of catastrophic fires, there is still a possibility that a major fire could occur. A fire that consumes less than half of any Preserved Area or if more than one Preserved Area is affected, less than 30 percent of the total amount of the Preserved Areas identified in the last Annual Report, would be considered changed circumstances. In the event of a major fire, Stanford will notify the wildlife agencies by telephone and email within 48 hours. Stanford will prepare a damage assessment report that assesses the extent of the damage to the Covered Species and the Preserved Area(s) and any known or suspected effects on the Covered Species occupying such lands, and identifies appropriate remedial measures, which would include active or passive habitat restoration measures for the affected Preserved Area(s) to facilitate native revegetation. This report will be submitted to the Service and NOAA Fisheries for review within 60 days after the fire. The agencies will then have 45 days to comment on the report, and if Stanford does not concur with the wildlife agencies' recommendations, Stanford and the wildlife agencies will confer to develop a mutually agreeable solution. Stanford may begin implementing remedial measures before submitting a report to the Service and NOAA Fisheries or receiving comments on the report to prevent further loss of habitat. Stanford will be responsible for funding and implementing any remedial measures.

If 50 percent or more of a Preserved Area, or 30 percent or more of the Preserved Areas cumulatively, are consumed by a fire, it will be treated as an unforeseen circumstance and addressed in accordance with Section 6.6.1, above.

Floods. The effect of a flood or prolonged periods of heavy rainfall on the Covered Species and on the Preserved Areas depends on several factors, including the severity of the flood event, its duration, and the type of habitat affected. Overall, the adverse effects of flood events on the Covered Species could be substantial. For example, floods could adversely affect steelhead or California red-legged frog reproduction by destroying larvae. Thus, flooding in successive years could have a long-term effect on steelhead or California red-legged frog populations. Moreover, in some cases flood damage could be significant, and could include pond damage, sedimentation, downed trees and shrubs, deposits of debris into creeks, bank de-stabilization, etc. Alternatively, because much of the Preserved Areas are riparian corridors, wetlands, and some grasslands and woodlands that naturally experience periodic flooding, these areas may be capable of absorbing the effects of flooding with minimal or transient damage.

If flooding adversely affects the Covered Species, Preserved Areas, or any facilities in a Preserved Area in a manner that requires an expenditure of funds in excess of those required for normal maintenance and management activities, or a 100-year flood event occurs, Stanford will notify the wildlife agencies by telephone and email within 48 hours. Stanford will prepare a damage assessment report that assesses the extent of the damage to the Covered Species and the Preserved Area(s) and any known or suspected effects on the Covered Species occupying such lands, and identifies appropriate remedial measures. Appropriate remedial measures would include active or passive habitat restoration measures for the affected Preserved Area(s) to facilitate native revegetation, repair or replacement of no less

[4] These factors include the following: size of the current range of the affected species; percentage of the range adversely affected; percentage of the range conserved by the HCP; ecological significance of that portion of the range; level of knowledge about the affected species and the degree of specificity of the species' conservation program under the HCP; whether the HCP was originally designed to provide an overall net benefit; and whether the failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild.

[5] The No Surprises rule was promulgated jointly by the Department of the Interior (Service) and the Department of Commerce (NOAA Fisheries).

than 50 percent of any damaged or destroyed California tiger salamander ponds, and creek bank stabilization measures. This report will be submitted to the Service and NOAA Fisheries for review within 60 days of the cessation of the flooding. The agencies will then have 30 days to comment on the report, and if Stanford does not concur with the wildlife agencies' recommendations, Stanford and the wildlife agencies will confer to develop a mutually agreeable solution. Stanford may begin implementing remedial measures before submitting a report to the Service and NOAA Fisheries or receiving comments on the report to prevent further loss of habitat or other adverse effects to the Covered Species. Stanford will be responsible for funding and implementing any remedial measures.

The potential damage from a storm event larger than a 100-year event is not foreseeable or predictable. Therefore, a flood and the damage resulting from an event greater than a 100-year event is considered an unforeseen circumstance and would be addressed in accordance with Section 6.6.1.

Drought. Defining when a drought occurs is difficult because there is no universal definition of the conditions that constitute a drought. A generic definition might be a "persistent and abnormal moisture deficiency having adverse impacts on vegetation, animals, or people." A drought is generally perceived as a serious departure from normal water conditions. The California Department of Water Resources (DWR) has used two primary criteria to evaluate the occurrence of a drought: runoff and reservoir storage. A drought threshold is considered to be runoff for a single year or multiple years in the lowest 10 percent of the historical range and reservoir storage for the same time period at less than 70 percent of average. However, even with these criteria, conditions often vary from region to region, or within a region, and potential changes in rainfall conditions due to climate change are still unknown. For purposes of this HCP, a drought of less than 6 years is a changed circumstance, and a drought of 6 years or longer is an unforeseen circumstance and would be addressed in accordance with Section 6.6.1.

Stanford will prepare a damage assessment report that assesses the effects on the Covered Species and the Preserved Area(s) (including the California tiger salamander ponds) and any known or suspected effects on the Covered Species occupying such lands, and identifies appropriate remedial measures. Remedial measures for the effects of drought are difficult to identify. Remedial measures may include temporary artificial water sources to sustain the California tiger salamander ponds or a reduction in the amount of water diverted from Los Trancos Creek.[6] Although Stanford may temporarily reduce water diversions to reduce the effects of a drought on the Covered Species, Stanford will not be required to reduce creek water diversions or otherwise relinquish any of its water rights to reduce such adverse affects. Adaptive management would be employed after drought conditions subside to facilitate breeding in ponds or creeks that were adversely affected by a drought.

If DWR declares 5 consecutive drought years, Stanford will prepare a damage assessment report. The damage assessment report will be submitted to the Service and NOAA Fisheries within 90 days of the declaration of 5 years of consecutive drought. The agencies will then have 30 days to comment on the report, and if Stanford does not concur with the wildlife agencies' recommendations, Stanford and the wildlife agencies will confer to develop a mutually agreeable solution. Stanford may begin implementing remedial measures before submitting a report to the Service and NOAA Fisheries or receiving comments on the report to prevent further loss of habitat or other adverse effects to the Covered Species. Stanford will be responsible for funding and implementing any remedial measures.

Droughts are not uncommon and historically have occurred about once every 30 years. Drought conditions may become more frequent due to changes in climate, although some predictions expect increased rainfall as a result of global climate change. As such, an increase or decrease in future drought conditions cannot be predicted at this time, and the potential damage from a prolonged drought is not foreseeable or predictable. Therefore, a drought and the damage resulting from a drought lasting 6 years or longer is considered an unforeseen circumstance and would be addressed in accordance with Section 6.6.1.

Non-Native Invasive Species. The Monitoring and Management Plans for the Preserved Areas are designed to control non-native plant and animal species that could harm the Covered Species or their habitat within the Preserved Areas, and Stanford will regularly monitor for any changes in invasive plant or animal species. The Preserved Areas could become infested with non-native plant or animal species that adversely affect the Covered Species or the quality of their habitat. For example, an uncontrollable infestation of fast-growing weed species could severely restrict water movement in the California tiger salamander ponds and reduce habitat quality. Large infestations of weedy species can become extremely expensive to control and could impose a financial burden on Stanford beyond that contemplated for the HCP. Similarly, there may be an invasion of non-native animal species that either prey on the Covered Species or degrade their habitat. A control program to eliminate the problem species also can be expensive.

If a non-native plant or animal infestation that adversely affects the Covered Species, Preserved Areas, or facilities within a Preserved Area requires an expenditure of funds in excess of those required for normal maintenance and management activities, or an infestation by any plant that is listed in the federal noxious weed list or California Department of Food and

[6] In the event of a drought, Stanford would assess which of the California tiger salamander ponds would benefit most from temporary artificial sources of water. In the case of a drought, where water resources may be limited, Stanford would not artificially sustain all of the ponds, but would choose at least one pond in consultation with the Service to artificially sustain, provided a water source is available.

Agricultural noxious weed list occurs in the Preserved Areas, Stanford will prepare a damage assessment report that assesses the extent of the damage to the Covered Species and the Preserved Area(s) and any known or suspected effects on the Covered Species occupying such lands, and identifies appropriate remedial measures, which would include control/removal of the invasive species and active or passive habitat restoration measures for the affected Preserved Area(s) to facilitate native revegetation. This report will be submitted to the Service and NOAA Fisheries for review within 60 days of discovering the infestation. The agencies will then have 45 days to comment on the report, and if Stanford does not concur with the wildlife agencies' recommendations, Stanford and the wildlife agencies will confer to develop a mutually agreeable solution. Stanford may begin implementing remedial measures before submitting a report to the Service and NOAA Fisheries or receiving comments on the report to prevent further loss of habitat or other adverse effects to the Covered Species. In the event Stanford finds a previously undocumented invasive species, such as fire ants, quagga mussels, or snapping turtles, that is having or could have an immediate significant adverse impact on the Covered Species, Stanford will notify the wildlife agencies by telephone and email within 48 hours.

If the cost of controlling invasive species exceeds 10 percent of the average annual conservation budget for 3 consecutive years, it will be treated as an unforeseen circumstance and addressed in accordance with Section 6.6.1, above.

Disease. The Monitoring and Management Plans for the Preserved Areas are designed to control and identify plant and wildlife diseases that could harm the Covered Species or their habitat within the Preserved Areas. Sudden oak death has been found at Stanford, including within the San Francisquito/Los Trancos Easement area, and has contributed to the death of several oak trees. Sudden oak death is also located on properties adjacent to Stanford lands. At this time, sudden oak death is not adversely affecting the Covered Species or their habitat, and the presence of sudden oak death on Stanford lands is considered minimal. However, many more oak and other trees may become infected with sudden oak death. There also may be an infestation of other pathogens, such as chytrid fungus, which could affect both California red-legged frogs and California tiger salamanders.

If Stanford finds that the spread of sudden oak death or a new disease in the Preserved Areas is adversely affecting the Covered Species or their habitat, or could adversely affect the Covered Species in the immediate future, Stanford will prepare a damage assessment report that assesses the extent of the damage to the Covered Species and the Preserved Area(s) and any known or suspected effects on the Covered Species occupying such lands, and identifies appropriate remedial measures, which would include control of the disease or removal of diseased species or plants, and active or passive habitat restoration measures for the affected Preserved Area(s). This report will be submitted to the Service and NOAA Fisheries for review within 60 days of discovering the infestation or spread of sudden oak death or new disease. The agencies will then have 45 days to comment on the report, and if Stanford does not concur with the wildlife agencies' recommendations, Stanford and the wildlife agencies will confer to develop a mutually agreeable solution. Stanford may begin implementing remedial measures before submitting a report to the Service and NOAA Fisheries or receiving comments on the report to prevent further loss of habitat or other adverse effects to the Covered Species. If Stanford finds a previously undocumented disease that is having or could have immediate significant adverse impacts on the Covered Species, Stanford will notify the wildlife agencies by telephone and email within 48 hours.

If an infestation by a new disease affects more than 25 percent of the Covered Species or their habitat within a Preserved Area, or more than 15 percent of the Covered Species or their habitat within the Preserved Areas cumulatively, it will be treated as an unforeseen circumstance and addressed in accordance with Section 6.6.1. Likewise, if the spread of sudden oak death affects more than 25 percent of the trees in a Preserved Area (not including trees that are already affected by sudden oak death) or more than 15 percent of the trees in the Preserved Areas cumulatively, it will be treated as an unforeseen circumstance and addressed in accordance with Section 6.6.1.

Toxic Substance Release and Illegal Dumping. Stanford employs best management practices that substantially reduce the chance of a toxic substance release and security precautions in the main campus to prevent trespassing. However, toxic substance releases and illegal dumping may occur on Stanford lands.[7] Undeveloped open space areas that are not fenced and are not regularly patrolled by the University are particularly vulnerable to illegal dumping. The release or dumping may directly or indirectly affect the Covered Species and their habitat.

Household garbage, construction materials from residential remodeling, and personal electronic equipment such as computers and printers are sometimes illegally dumped on Stanford lands. The dumping of these kinds of items in the Preserved Areas is therefore considered reasonably likely to occur during the permit term and is considered a changed circumstance.

Toxic substances, even in very small quantities, can be extremely expensive to remediate and responsible parties are often difficult to identify. If a toxic substance is found in a Preserved Area, or the Conservation Program Manager determines that a toxic substance located elsewhere is adversely affecting the Covered Species within a Preserved Area, Stanford will notify the wildlife agencies by telephone and email within 24 hours and prepare and submit to the wildlife agencies a damage as-

[7] "Toxic" substances or materials include all "hazardous materials" defined by 42 U.S.C. §9601(14) and the regulations promulgated pursuant to 42 U.S.C. §9601 *et seq.*

sessment report within 45 days. The damage assessment report will identify the party responsible for releasing the toxic substance, if known; appropriate remedial measures, including ways in which future toxic releases can be prevented; the extent of the damage to the Covered Species and the Preserved Area(s); and any known or suspected effects on the Covered Species occupying such lands. The agencies will have 30 days to comment on the report, and if Stanford does not concur with the wildlife agencies' recommendations, Stanford and the wildlife agencies will confer to develop a mutually agreeable solution. Stanford may begin implementing remedial measures before submitting a report to the Service and NOAA Fisheries or receiving comments on the report to control the toxic substance or prevent further damage.

If the toxic substance was released by any person or entity other than Stanford, and it costs no more than $200,000 to remediate (in 2009 dollars, adjusted for inflation), it will be treated as a changed circumstance that Stanford is responsible for remediating. If the toxic substance release costs in excess of $200,000 to remediate, it will be treated as an unforeseen circumstance and addressed in accordance with Section 6.6.1.

If Stanford released the toxic substance that adversely affects the Covered Species, then Stanford is responsible for remediating all of the damage to the affected Preserved Area(s).[8] As such, any release of a toxic substance by Stanford is considered a changed circumstance.

Listing of New Species. If currently unlisted species that are addressed in this HCP as a Covered Species are subsequently listed, no action is required by Stanford or any subpermittee that is covered by a Certificate of Inclusion. All of the Covered Species will be named on the federal permits and, under the terms of the permits, any currently unlisted Covered Species will automatically be covered effective upon the final listing of any such species under the ESA. Therefore, if the Service lists a Covered Species during the permit term, take coverage will become effective for that species at the time of listing. No changes to the terms and conditions of the IA or modifications to conservation measures are required. However, currently unlisted species that are not Covered Species in the HCP will not be included in the incidental take permits and therefore will not automatically be covered if listed. The HCP, IA, and incidental take permits may be amended, in accordance with Section 6.7.1 below to include any unlisted species that is not a Covered Species under the HCP.

Take Authorization for Additional Species. If a currently listed species, such as the Bay checkerspot butterfly, or newly listed species that is not addressed in the HCP is found at Stanford, and Stanford, the Service, or NOAA Fisheries determines that Stanford is engaging in activities that will result in the take of the listed species, the HCP, IA and incidental take permit may be amended in accordance with Section 6.7.1. Although portions of the Jasper Ridge Biological Preserve at Stanford provide Critical Habitat for the Bay checkerspot butterfly, the species has not been documented at Stanford for more than a decade, and is therefore not included as a Covered Species. If the Bay checkerspot butterfly or other listed species is found at Stanford, the occurrence will be reported in the Annual Report, and the Conservation Program Manager will assess whether Stanford's activities are likely to affect the species. The agencies will have 30 days following receipt of the Annual Report to comment on the documented occurrence and on whether, in the responsible agency's opinion, an amendment to the HCP, IA and incidental take permit is warranted. If Stanford concludes that its activities may affect the listed species, Stanford may initiate an amendment in accordance with Section 6.7.1 at any time.

6.7 AMENDMENTS AND MINOR MODIFICATIONS

Amendment of a Section 10(a)(1)(B) permit is required when the permittee wishes to significantly modify an activity or a conservation program described in the original HCP. Such modifications may include the addition of a species to the permit that was not addressed in the original HCP, significant adjustments to the HCP necessitated by unforeseen circumstances, or alterations in funding. A permit amendment generally requires the permittee to follow the same process as the original permit application, and requires an amendment to the HCP addressing the new circumstances. However, the documentation required, especially for compliance with the National Environmental Policy Act (NEPA), is generally much less for a permit amendment than for the original application. (See 40 C.F.R. 1502.20.)

Alternatively, some amendments commonly needed over the life of an HCP are minor and can be done in an expedited fashion, without public notice and review. This includes certain modifications to the HCP, such as adaptive management changes discussed above. The process for both formal amendments and minor modifications are addressed below.

6.7.1 Amendments

Amendments to Stanford's incidental take permits, HCP, or the IA may be proposed by Stanford, the Service, or NOAA Fisheries. The party proposing the amendment shall provide the other parties with a written statement of the reasons for the amendment and an analysis of the effect of the amendment on the environment, Covered Species, and the implementation of the HCP. The permits may be amended in accordance with all

[8] Stanford's responsibility for the release of a toxic substance extends to any Stanford employee that releases a toxic substance during the course of performing his or her job, but does not include contractors, subcontractors, lessees, or others who are not employees of Stanford University.

applicable legal requirements, including, but not limited to, the ESA, NEPA, and regulations issued by the Service and NOAA Fisheries in effect at the time of the proposed amendment.

6.7.2 Minor Modifications

Minor modifications may be made to the incidental take permits, HCP, or IA by Stanford, the Service, or NOAA Fisheries. Minor modifications may include, but are not limited to, the following: 1) correction of typographic, grammatical, and similar editing errors that do not change the intended meaning, 2) correction of any maps or exhibits to correct errors in mapping or to reflect previously approved changes, 3) minor changes to survey, monitoring, or reporting protocols and similar revisions, 4) the addition of new Covered Activities provided the activity will not result in an adverse effect on the environment that is new or significantly different from those analyzed in connection with the original HCP, or result in the additional take of a Covered Species, and (5) the addition of CDFG as a reviewing, consulting, participating, or approving party for any action that could result in take of a Covered Species, or benefit a Covered Species, listed as threatened or endangered under CESA. All minor modifications must be approved by Stanford and the wildlife agency that has jurisdiction over the species that will be affected by the modification.

The Service and/or NOAA Fisheries will not approve a minor modification if either agency determines that such modification would: 1) result in operations under the HCP that are significantly different from those analyzed in connection with the original HCP, 2) result in adverse effects on the environment that are new or significantly different from those analyzed in connection with the original HCP, or 3) allow significant additional take not analyzed in connection with the original HCP. Stanford will not approve a minor modification if it determines the modification would: 1) affect the cost of implementing the HCP, incidental take permits, or IA, 2) restrict development of Stanford lands beyond the restrictions imposed by the original HCP, incidental take permits, or IA, or 3) result in operations under the HCP that are significantly different from those permitted by the original HCP.

The party proposing a minor modification shall provide the other parties with a statement of the reasons for the proposed modification and an analysis of its environmental effects, its effects on the implementation of the HCP and on the Covered Species. The parties must respond to proposed modifications within 45 days of receipt of such notice. Proposed minor modifications will become effective upon the written approval of the other parties, or upon expiration of the 45-day time period if no written objection is made by another party. If a receiving party objects to a proposed minor modification within the 45-day time period, the proposed modification must be processed as an amendment pursuant to Section 6.7.1.

6.7.3 Land Use Changes

During the life of the HCP, the counties of San Mateo and Santa Clara and the cities of Palo Alto, Menlo Park, Portola Valley, and Woodside may adopt or amend their general plans, specific plans, community plans, zoning ordinances, and similar land use regulations, and may grant Stanford land use entitlements pursuant to these land use regulations. Such land use matters are within the sole discretion of these counties and cities, and shall not require amendments to the HCP or IA or require the approval of the Service or NOAA Fisheries. However, any land use entitlement granted to Stanford must be implemented in a manner that is consistent with the HCP, IA, and incidental take permits, or they must be modified to be consistent.

6.8 ENFORCEMENT OF SECTION 10(a)(1)(B) PERMITS

The provisions of the HCP are enforceable through the terms and conditions of the Section 10(a)(1)(B) permits issued by the Service and NOAA Fisheries and the IA.

6.8.1 Suspension/Revocation

The Service or NOAA Fisheries may suspend or revoke their respective permits if Stanford fails to implement the HCP in accordance with the terms and conditions of the permits or if suspension or revocation is otherwise required by federal law. Suspension or revocation of a Section 10(a)(1)(B) permit, in whole or in part, must be in accordance with 50 CFR 13.27-29, 17.22 (b)(8), and 17.32 (b)(8) and the IA.

6.8.2 Certificates of Inclusion

Take authorization may be provided to Stanford's subpermittees by the issuance of Certificates of Inclusion. Stanford may issue Certificates of Inclusion to each subpermittee only after:

- Stanford enters into a contract with the subpermittee binding the subpermittee to the relevant terms of the HCP;
- Stanford finds that the subpermittee's proposed activity complies with all terms and requirements of the HCP, related permits, and the IA;
- The impacts of the proposed activity fall within those analyzed in the HCP in general type, magnitude, and effects; and
- The subpermittee has implemented all of the relevant Minimization Measures, and any additional Best Management Practices the Conservation Program Manager deems necessary.

Take authorization also may be provided to entities such as PG&E, SFPUC, and the Santa Clara Valley Water Department that own facilities on Stanford's lands. Certificates of Inclusion will be issued only to those entities that agree to abide by the provisions of the HCP, IA, and incidental take permits. In the event that the Service or NOAA Fisheries suspends or revokes a permit issued to Stanford, the take authorizations afforded subpermittees holding Certificates of Inclusion will remain in effect provided the subpermittee(s) continues to comply with the terms and conditions of the permits. If the Conservation Program Manager determines a subpermittee is not in compliance with the HCP, IA, or incidental take permits, the Conservation Program Manager, Service, or NOAA Fisheries may revoke the Certificate of Inclusion. The revocation of such Certificate of Inclusion shall not affect Stanford's take authorization provided Stanford continues to comply with the terms and conditions of the permits and undertakes any remedial actions necessary to remediate any violation by the holder of the Certificate of Inclusion.

6.8.3 Notice

Any notice required under the HCP or IA must be given in writing and delivered by personal delivery or certified mail/return receipt requested, unless the HCP specifically authorizes an alternative form of delivery (such as electronic mail delivery).

6.9 RELATIONSHIP OF THE HCP TO OTHER ESA POLICIES AND REQUIREMENTS

6.9.1 Relationship of HCP to Future Section 7 Consultations

The Service and NOAA Fisheries will evaluate the direct, indirect, and cumulative effects of the activities covered by the HCP in its internal Biological Opinion issued in connection with the HCP and the issuance of Section 10(a)(1)(B) permits. The HCP is not intended to alter the obligation of a federal agency to consult the Service or NOAA Fisheries pursuant to Section 7 of the ESA. However, if Stanford undertakes a project after issuance of the Section 10(a) permits under the HCP, such as an enhancement measure, that involves a federal action subject to Section 7 of the ESA concerning a Covered Species, the Service and/or NOAA Fisheries shall ensure to the extent permitted by law that the Biological Opinion issued in connection with the proposed project is consistent with the Biological Opinion for the HCP. The proposed project must be consistent with the terms and conditions of the HCP, IA and permits. Any reasonable and prudent measures included under the terms and conditions of a Biological Opinion issued subsequent of the effective date of the HCP shall be consistent with the implementation of the HCP, IA, and permits unless otherwise required by law or regulation. Subject to the laws and regulations then in effect, if the measures required under the HCP, IA, and permits will adequately ensure the proposed project will not jeopardize the continued existence of the Covered Species affected by the project, only those measures will be imposed as reasonable and prudent measures under the Biological Opinion, and unless otherwise required by law or regulation, the Service and/or NOAA Fisheries will not impose measures beyond those required under the HCP, IA, or permits. Before completing a Section 7 consultation for a Covered Activity in which the Service or NOAA Fisheries proposes to require a measure in excess of the requirements of the IA, HCP, or permits, the Service and/or NOAA Fisheries will meet and confer with Stanford to discuss alternatives to the imposition of the measures that would meet the applicable legal or regulatory requirements.

Based on the information processed during the preparation of this HCP, the Service and NOAA Fisheries have concluded that their approval of the HCP and IA and issuance of incidental take permits are not likely to jeopardize the continued existence of the Covered Species or result in adverse modification of any Critical Habitat. Moreover, these approvals would not jeopardize the continued existence of any other species or plants listed as threatened or endangered under the ESA.

6.9.2 Relationship to Other HCPs and Non-Stanford Related Activities

Several public agencies, including the City of Palo Alto, County of Santa Clara, County of San Mateo, and the Santa Clara Valley Water District, have facilities and easements on Stanford lands. For example, the City of Palo Alto maintains utilities that are located in Matadero Creek, and the Santa Clara Valley Water District performs routine maintenance, including trash removal, fence and access repair, and removal of downed trees or other blockages, within all of the creeks in the area. As discussed in other portions of the HCP, Stanford has no control over the activities of these public agencies, and their activities are not covered under the HCP. Some of the facilities owned by these agencies are located on Stanford's lands and have been identified under the Covered Activities section of the HCP. The presence of the facilities is covered under the HCP. One or more of these public agencies may seek permits from the Service and/or NOAA Fisheries and to include facilities or activities located on Stanford's lands in such permit or HCP. Any measures included under the terms and conditions of any subsequent permit or HCP developed pursuant to such permit that affects Stanford's lands shall be consistent with the implementation of this HCP and IA. The Service and/or NOAA Fisheries will not impose measures on Stanford beyond those required under this HCP.

6.9.3 Critical Habitat

Critical Habitat identifies specific areas, both occupied and unoccupied, that are essential to the conservation of a listed species and that may require special management considerations or protection. Pursuant to federal regulations, the Service issued final rules designating Critical Habitat for the California tiger salamander, Bay checkerspot butterfly, and California red-legged frog, and NOAA Fisheries issued a final rule designating Critical Habitat for steelhead. None of Stanford's lands were designated as Critical Habitat for the California tiger salamander (70 Fed. Reg. 41183-41186 (August 23, 2005)), or California red-legged frog (71 Fed. Reg. 19244-19346 (April 13, 2006)) and the Covered Activities will therefore not result in the destruction or adverse modification of Critical Habitat for these species. The Service has not designated Critical Habitat for the San Francisco garter snake, and the HCP will therefore not affect any San Francisco garter snake Critical Habitat. San Francisquito Creek, Bear Creek and Los Trancos Creek, including the portions of the creeks that flow through Stanford's lands were designated as Critical Habitat for steelhead. 70 Fed. Reg. 52488, 52563 (September 2, 2005). Implementation of the HCP will not adversely affect Critical Habitat in the creeks. Part of the Jasper Ridge Biological Preserve was proposed as Critical Habitat for the Bay checkerspot butterfly. 73 Fed. Reg. 50405-50452 (August 26, 2008). Implementation of the HCP will not adversely affect Critical Habitat within the Preserve.

Critical Habitat for the western pond turtle has not been proposed because the turtle is not a listed species under the ESA. If the western pond turtle is listed during the life of the HCP and any portion of the land subject to this HCP are designated as Critical Habitat for the species, the provisions set forth in this HCP will adequately preserve and enhance the western pond turtle and any Critical Habitat designated for the species. The Adaptive Management Provision described in Section 4.5 allows for revisions to management strategies to incorporate new management strategies, such as those included in recovery plans. However, any changes to the management strategies set forth in the Conservation Program should be considered in light of the entire HCP, and the overall purpose and goals of the HCP. A specific purpose of the HCP is to establish a conservation program that benefits all of the Covered Species, by, in part, implementing Monitoring and Management Plans that protect and enhance western pond turtle habitat. Implementation of the Monitoring and Management Plans will ensure the Covered Activities do not adversely affect any western pond turtle habitat (whether or not it is listed as Critical Habitat) that is within the San Francisquito/Los Trancos Easement or Matadero/Deer Easement. In the event that any land outside of the San Francisquito/Los Trancos Easement or Matadero/Deer Easement is designated as Critical Habitat for the western pond turtle, the San Francisquito/Los Trancos Easement Monitoring and Management Plan or Matadero/Deer Easement Monitoring and Management Plan, depending on the location of the Critical Habitat designation, will be used to manage those Critical Habitat areas as well. Thus, no additional measures will be required in the event any of Stanford's lands are designated as Critical Habitat for the western pond turtle.

6.9.4 Recovery Plans

Recovery plans under the ESA identify actions deemed necessary to recover a federally listed species. The HCP is consistent with the provisions of the California Red-Legged Frog Recovery Plan, and the Recovery Plan for Serpentine Grassland Species in the Bay Area. However, recovery plans do not obligate permittees to undertake specific tasks.

At the time of approval of the HCP, a recovery plan had not been adopted by the Service for the California tiger salamander and no recovery plan had been adopted by NOAA Fisheries for steelhead. However, during the life of the HCP, recovery plans may be adopted for these Covered Species. The Adaptive Management Provision allows for revisions to management strategies to incorporate new management strategies, such as those included in recovery plans. However, it is necessary to define the scope of such revisions with respect to the HCP's purpose and goals. A specific purpose of the HCP is to establish a conservation program that minimizes and mitigates the effects of projected urban and other development on the Covered Species, and provides the Covered Species with a net benefit. With respect to the recovery of the Covered Species, it is the intent of the HCP to contribute to such recovery to the maximum extent feasible consistent with the HCP's other goals and purposes. It is the intent of the HCP not to preclude or undermine recovery efforts for any of the Covered Species.

Therefore, the HCP will incorporate recommendations contained in future recovery plans when such recommendations:

- Are expected to increase the effectiveness of the HCP's conservation and mitigation programs by identifying relevant new information, approaches, techniques, or species protection needs,
- Can be achieved without any greater cost to Stanford, and
- Fit within the overall intent, framework, and funding levels of the HCP.

All such recovery plan revisions will be subject to the Adaptive Management Provision described in Section 4.5, and Minor Modifications process described in Section 6.7.2.

SECTION 7
ALTERNATIVES TO TAKE

7.0 ALTERNATIVES TO TAKE

The ESA requires Section 10 applicants to consider alternative actions to the take of federally listed species and explain the reasons why those alternatives were not selected. The *Habitat Conservation Planning and Incidental Take Permit Processing Handbook* (U.S. Fish and Wildlife Service and National Marine Fisheries Service 1996) identifies two alternatives commonly considered in HCPs: (1) an alternative that would take below levels anticipated for the proposed project, and (2) a no action alternative, in which no permit would be issued and take would be avoided. This Section of the HCP discusses four alternatives, including a no action alternative and reduced take alternative, and two alternatives to the Conservation Program. For the reasons described below these alternatives were not selected.

7.1 NO ACTION ALTERNATIVES

7.1.1 No Take

Under the no action-no take alternative, Stanford would not engage in any activities that would result in a take of the Covered Species, and therefore would not need incidental take permits from the Service or NOAA Fisheries. As discussed in Section 3.0 of the HCP, some of the day-to-day operations of the University may result in the take of Covered Species. These include operations required for public health and safety, supplying water, and providing other utilities. It is infeasible for Stanford to stop these day-to-day operations without jeopardizing the functioning of the University and public health and safety. Therefore, the no action-no take alternative was rejected.

7.1.2 Project-by-Project Permitting

Under the no action-project-by-project permitting alternative Stanford would apply for individual take permits as needed to carry out ongoing activities and for future development that would result in take of federally listed species. Project-by-project permitting would occur through future Section 7 consultations or under Section 10 of the ESA with the preparation of a low-effect HCP. Only land conversions and ongoing activities that would result in the actual take of a listed species would require an incidental take permit. Since Zone 3 land only provides incidental benefit to the Covered Species and does not actually support the Covered Species, ongoing activities and future development in Zone 3 would not require a permit from the Service or NOAA Fisheries. Incidental take authorization and associated mitigation for the western pond turtle would not be required unless it is listed. Mitigation associated with individual incidental take authorization for the ongoing Covered Activities would likely be similar to the Minimization Measures proposed under the HCP. However, they would only apply to ongoing activities in Zones 1 and 2. Mitigation for future development projects would likely be similar to the permanent land preservations proposed under the HCP to compensate for the loss of Zone 1 and 2 habitat. However, land preservation would occur much later in time, when the future development occurred, and no mitigation would be required for development solely within Zone 3, or for development in Zone 4. This alternative would result in piecemeal preservation and management of habitat that was loosely coordinated, if at all, with prior mitigation requirements. Thus, this alternative was rejected because it would result in a biologically inferior outcome.

7.2 PERMIT TAKE FROM ON-GOING OPERATIONS ONLY

Under this alternative, all of the Covered Activities except the future development described in Section 3.10 would be permitted. As described in the HCP, Stanford anticipates constructing the development permitted by the General Use Permit, and an additional 5 to 15 acres of land in Zone 1, and 10 to 30 acres of land in Zone 2. The University could not function without continued redevelopment and development, and would therefore seek other permitting means to accomplish the necessary development. The future development would be addressed by the wildlife agencies on a project-by-project basis. Under this alternative, Stanford would not set aside any habitat in the San Francisquito/Los Trancos and Matadero/Deer easements or create the CTS Reserve. Likewise the Monitoring and Management Plans for the easements, CTS Reserve, and Central Campus CTS Management Area would not be implemented. Instead, Stanford would set aside land, and manage the preserved habitat, at different times during the life of the HCP. Thus, habitat preservation would occur much later, and only on an as-needed basis to mitigate for a specific project. Eliminating future development from the Covered Activities would therefore result in a minimal reduction in the amount of take and in the long run could reduce the amount of land preserved for the Covered Species. Moreover, the benefits associated with the preservation and active monitoring and management of the Covered Species' habitat would be delayed. This alternative was therefore rejected because it would result in a biologically inferior outcome.

7.3 ALL OFF-SITE LAND CONSERVATION ALTERNATIVE

As part of the HCP's Conservation Program, Stanford is proposing to manage and conserve about 700 acres of land within the San Francisquito/Los Trancos Easement, Matadero/Deer Easement and CTS Reserve. In addition, the Conservation Program provides Stanford with an incentive for enhancing and protecting additional on-site land that could serve as important habitat for the Covered Species. As an alternative to the Conservation Program, Stanford considered seeking permits to develop the entire site and mitigate for the impacts of future development by conserving only off-site land. Under this alternative, no easements to protect the Covered Species would be placed on Stanford's lands. Instead, Stanford would acquire off-site land that provides suitable habitat for the Covered Species and place conservation easements on those lands.

This alternative would not meet several of the HCP's Biological and Institutional Goals, such as preserving and enhancing on-site habitat, and likely would not meet the objective of implementing cost effective conservation measures. Also, it is inconsistent with Stanford's land use policies that recognize Stanford's commitment to respect the University's lands. This alternative was therefore rejected.

SECTION 8
KEY REFERENCES

8.0 KEY REFERENCES

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APPENDICES

APPENDIX A
Steelhead Habitat Enhancement Project - Biological Opinion and Streambed Alteration Agreement

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

In response refer to:
2006/00892

[illegible] 2 1 2006

Lieutenant Colonel Craig W. Kiley
District Engineer
U.S. Department of the Army
San Francisco District, Corps of Engineers
1455 Market Street, 16th floor
San Francisco, California 94103-1398

Dear Colonel Kiley:

This document transmits NOAA's National Marine Fisheries Service's (NMFS) biological opinion (Enclosure) for Stanford University's (Stanford) Steelhead Habitat Enhancement Project (SHEP), which, among other things, proposes modifications to the facilities and operational procedures at the San Francisquito Creek Pump Station in San Francisquito Creek, and the Los Trancos Creek Fish Ladder and Diversion Structure in Los Trancos Creek, on lands under ownership and management by Stanford, on the border of Santa Clara and San Mateo counties, California (File No. 28630S). The biological opinion describes NMFS' analysis of the effects of the construction of the facilities and subsequent operations of these facilities on threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) and on designated critical habitat for CCC steelhead in accordance with section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*)

In the enclosed biological opinion, NMFS concludes that this project is not likely to jeopardize the continued existence of threatened CCC steelhead. NMFS has also concluded the proposed project is not likely to result in the destruction or adverse modification of critical habitat for CCC steelhead. However, NMFS anticipates take of CCC steelhead will occur as a result of project construction. An incidental take statement with non-discretionary terms and conditions is included with the enclosed biological opinion. Additionally, operation of Stanford's diversion and pumping facilities in Los Trancos and San Francisquito creeks will result in on-going take of CCC steelhead. Stanford, in coordination with NMFS and the California Department of Fish and Game, has developed an operations plan with fish bypass flows for San Francisquito Creek Pump Station and Los Trancos Creek Fish Ladder and Diversion Structure that provides suitable instream flow conditions for threatened CCC steelhead below each facility. This operations plan was submitted to the Corps by Stanford on July 7, 2006, to be incorporated into the project description for the SHEP. The enclosed biological opinion analyzes the potential affects on CCC steelhead and designated critical habitat associated with the on-going operation of the two above listed facilities under Stanford's proposed *Operations and Bypass Procedure*, dated July 6, 2006.

Provided Stanford continues to operate in conformance with the *Operations and Bypass Procedure*, dated July 6, 2006, contained in the project description, the amount or extent of incidental take anticipated in this biological opinion and incidental take statement are not expected to be exceeded. However, if operations change in a manner that causes an adverse effect to listed species or critical habitat that was not considered in the biological opinion, the incidental take statement included with the enclosed biological opinion may no longer apply.

Please contact Mr. Gary Stern at (707) 575-6060 if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

Rodney R. McInnis
Regional Administrator

Enclosure

cc: Russ Strach, NMFS - Sacramento, CA
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Copy to file (ARN #151422SWR2004SR9240)

Enclosure

BIOLOGICAL OPINION

ACTION AGENCY: U.S. Army Corps of Engineers, San Francisco

ACTION: Stanford University's Steelhead Habitat Enhancement Project at the San Francisquito Creek Pump Station in San Francisquito Creek and the Los Trancos Creek Fish Ladder and Diversion Structure in Los Trancos Creek

CONSULTATION CONDUCTED BY: National Marine Fisheries Service, Southwest Region

TRACKING NUMBER: 2006/00892

DATE ISSUED: April 21, 2008

I. CONSULTATION HISTORY

At the request of the California Department of Fish and Game (CDFG), NOAA's National Marine Fisheries Service (NMFS) became involved in fish passage issues at Stanford University's (Stanford) Felt Lake water intake on Los Trancos Creek in 2001. Stanford installed a fish screen and fish ladder at the Los Trancos Diversion in 1995, but the amount of bypass flow released to Los Trancos Creek below the diversion dam was in dispute with CDFG. NMFS became actively engaged in the discussions with CDFG and Stanford from 2004 through 2006. During 2005, NMFS conducted field studies on San Francisquito Creek. The results of this work were presented by NMFS in the February 2006 report, "*An assessment of bypass flows needed to protect steelhead below Stanford University's water diversion facilities on Los Trancos Creek and San Francisquito Creek*". In July 2006, Stanford, CDFG and NMFS agreed to an operations plan for Stanford's water intake facilities on Los Trancos Creek and San Francisquito Creek. This operations plan, with fish bypass flows, has been incorporated into Stanford's proposed Steelhead Habitat Enhancement Plan (SHEP) which is the subject of this consultation.

On December 18, 2001, representatives from the NMFS Santa Rosa Area Office attended a Los Trancos Creek site visit with staff from CDFG and Stanford. Earlier in the year, a consultant for Stanford, Francis Borcalli, completed an evaluation of fish passage and water diversion at the Felt Lake intake on Los Trancos Creek (Borcalli & Associates 2001).

By letter dated December 10, 2003, Stanford provided to NMFS background information regarding the San Francisquito Creek watershed, Stanford's Los Trancos Diversion facility, and monitoring efforts by Stanford in the watershed.

Technical drawings dated August 31, 2002, prepared by Wood Rogers Inc. for the design of a replacement fish ladder and water diversion structure on Los Trancos Creek were provided to NMFS in January 2004.

NMFS attended the March 10, 2004, Interagency Meeting hosted by the Corps in San Francisco. Attendees included representatives from the Environmental Protection Agency, NMFS, U.S. Army Corps of Engineers (Corps) and San Francisco Bay Regional Water Quality Control Board. At this meeting, Stanford presented plans to modify the Felt Lake water intake facility on Los Trancos Creek.

In April 2004, Stanford provided to NMFS preliminary engineering design criteria for the new fish ladder and fish screen at the Los Trancos Creek diversion dam prepared by Wood Rodgers, Inc. dated April 13, 2004 (Wood Rodgers 2004).

On May 13, 2004, Stanford hosted a meeting with NMFS, CDFG, and the Corps to introduce the proposed Los Trancos fish ladder and fish screen project.

On August 3, 2004, Stanford provided to NMFS by mail a report describing fish passage monitoring and evaluation on Los Trancos Creek. The report was written by Carmen Ecological Consulting, a consulting biology firm hired by Stanford.

On November 15, 2004, NMFS and CDFG met in Santa Rosa to discuss available information and Stanford's operational plans for the Los Trancos Diversion.

In response to a request from NMFS and CDFG, Stanford provided a report dated December 19, 2004, with analysis of water diversion/bypass scenarios for the Los Trancos Diversion facility.

By letter dated March 7, 2005, Stanford provided to NMFS additional results from Carmen Ecological Consulting's fish passage evaluation on Los Trancos Creek and a DVD with a video recording of the stream under various flow conditions.

On April 20, 2005, Stanford met with NMFS and CDFG regarding the results of Carmen Ecological Consulting's fish passage evaluation. At this meeting, Stanford proposed a revised description of project operations at the Los Trancos diversion.

Discussions regarding Stanford's operations at the Los Trancos facility continued at a meeting on May 17, 2005, with NMFS, CDFG, and Stanford. NMFS and CDFG continued to indicate the need for higher bypass flows on Los Trancos Creek, and Stanford expressed concern with their ability to fill Felt Lake each year. Higher minimum bypass flow below the Los Trancos

Diversion facility would limit the volume of water available to Stanford for its historic irrigation practices. At this meeting, the group began to develop the idea of offsetting Stanford's water supply reductions on Los Trancos Creek by increasing pumping rates at the San Francisquito Pump Station. Reductions in Stanford's diversions from Los Trancos Creek during low flow periods could be offset by increased diversions at Stanford's existing diversion facility located downstream on San Francisquito Creek where natural flow is much higher during winter months. Thus, the SHEP began to incorporate modifications at the San Francisquito Pump Station to recapture some of the increased bypass flow originating from Los Trancos Creek.

During May and June 2005, NMFS biologist, Dr. Bill Hearn, and Stanford's consultant, Bill Carmen, gathered site-specific information on Los Trancos and San Francisquito creeks to assess fish passage, and steelhead (*Oncorhynchus mykiss*) spawning and rearing habitat below Stanford's Felt Lake water intake on Los Trancos Creek and below Stanford's pumping plant on San Francisquito Creek.

In June 2005, Stanford provided further results of biological surveys performed by Carmen Ecological Consulting assessing steelhead passage and habitat quality on Los Trancos Creek.

Meetings amoung NMFS, CDFG, and Stanford continued on June 22, 2005, and September 23, 2005, to develop an operations plan that coordinated water diversions at Stanford's Los Trancos Creek and San Francisquito Creek facilities.

On September 14, 2005, NMFS provided to Stanford a draft report entitled "*An assessment of bypass flows needed to protect steelhead below Stanford University's water diversion facilities on Los Trancos Creek and San Francisquito Creek*". This NMFS report presented the result of field work performed by NMFS biologist, Dr. Bill Hearn, and Stanford's consultant, Bill Carmen. The report also utilized existing information regarding hydrology and steelhead habitat to assess the instream flow needs of steelhead in the two creeks.

On September 28, 2005, Stanford's consultant, Olberding Environmental, Inc., submitted to the Corps a revised and expanded project description for the replacement of Stanford's water diversion facilities. This expanded project description included modifications at the San Francisquito Pump Station in addition to the previously proposed modifications at the Los Trancos Diversion facility.

On October 11, 2005, Stanford submitted to the Corps a pre-construction notification package and nationwide permit application for the proposed construction of the Steelhead Habitat Enhancement Project (SHEP) at Los Trancos, Felt Reservoir, and San Francisquito Creek. The SHEP proposal includes modifications to Stanford's water diversion facility on Los Trancos Creek (Los Trancos Diversion) and expansion of the water pumping facility on San Francisquito Creek (San Francisquito Pump Station).

In November 2005, Stanford distributed to the Corps and NMFS a biological assessment for the SHEP prepared by Olberding Environmental, Inc.

By letter dated November 28, 2005, Stanford provided NMFS a summary of its analysis of alternative fish bypass scenarios and provided comments on the NMFS September 2005 draft report assessing steelhead bypass flow requirements.

By letter dated January 30, 2006, the Corps requested initiation of formal consultation with NMFS for Stanford's proposed SHEP.

On February 15, 2006, NMFS issues the final report titled "*An assessment of bypass flows to protect steelhead below Stanford University's water diversion facilities on Los Trancos Creek and San Francisquito Creek.*" This report describes a water diversion plan developed by NMFS and CDFG that would minimize impacts to steelhead while affording Stanford its water supply from Los Trancos and San Francisquito creeks. The report also describes the approach and methods employed to develop recommended minimum bypass flows and maximum rates of diversion for Stanford's facilities on Los Trancos and San Francisquito creeks.

By letter dated February 17, 2006, NMFS provided comments to Stanford on the university's November 28, 2005, proposal for operation of the Los Trancos and San Francisquito water diversions. The NMFS letter also provided comments on Stanford's November 2005 water supply assessment.

On February 21, 2006, NMFS and Stanford representatives attended the San Francisquito Watershed's Steelhead Task Force meeting to present the SHEP and its associated steelhead issues to the task force.

By letter dated February 23, 2006, NMFS informed the Corps that the January 30, 2006, consultation initiation request was incomplete, because it lacked information regarding the proposed operation of the facilities and the operational effects of the facilities on steelhead and designated critical habitat. The Corps' biological assessment contained information regarding the construction aspects of the project, but did not describe how the operation of the facilities would affect streamflows in Los Trancos and San Francisquito creeks.

On March 2, 2006, representatives from Stanford, NMFS, and CDFG met to discuss fish bypass flows and operation of Stanford's water diversion facilities.

By electronic mail message dated March 7, 2006, Stanford provided to NMFS and CDFG a revised fish bypass flow and operations plan for the University's water diversion facilities on Los Trancos and San Francisquito creeks.

By electronic mail message dated March 10, 2006, NMFS provided comments to Stanford and the Corps regarding Stanford's proposed revisions to bypass flow and operations plan.

By letter dated April 13, 2006, from Stanford to NMFS, Stanford clarified its approach and proposed modifications to the SHEP diversion facilities. The letter responded to comments presented in the February 17, 2006, letter from NMFS to Stanford and the March 10, 2006, electronic mail message from NMFS to Stanford.

By electronic mail message on the morning of April 24, 2006, from NMFS to Stanford and the Corps, NMFS outlined information needs to complete the section 7 consultation on the SHEP. During the afternoon of April 24, 2006, NMFS, CDFG, and the San Francisco Bay Regional Water Quality Control Board met with Stanford to discuss fish bypass flows, water diversion operations, and state permitting requirements.

By electronic mail message on May 5, 2006, Stanford provided NMFS and CDFG a revised proposal for fish bypass flows and water diversion operations on Los Trancos and San Francisquito creeks.

By letter dated July 7, 2006, Stanford provided the Corps a revised description of fish bypass flows and operations plan for the SHEP facilities on Los Trancos and San Francisquito creeks. This operations plan with fish bypass flows was the final result of approximately two years of discussions among NMFS, CDFG, and Stanford. This version of the SHEP operations plan has been incorporated into the project description of this biological opinion.

On September 7, 2006, Stanford provided to NMFS design plans dated August 15, 2006, for new fish screens at San Francisquito pumping plant.

On September 18, 2006, Stanford distributed a proposed "*Wetland and riparian mitigation and monitoring plan for permanent impacts*" for SHEP prepared by Olberding Environmental, Inc.

On February 28, 2007, Stanford provided NMFS design plans dated February 12, 2007, for new fish screens at San Francisquito pumping plant.

During October 2007, Stanford distributed a revised proposal for the "*Wetland and riparian mitigation and monitoring plan for temporary impacts*" associated with construction of the SHEP prepared by Olberding Environmental, Inc.

On October 18, 2007, Stanford distributed the "*Biological impact minimization plan*" for the SHEP prepared by Olberding Environmental, Inc.

By letter dated February 6, 2008, to NMFS, Stanford requested the biological opinion for the SHEP be completed immediately.

In a February 25, 2008, letter, NMFS informed Stanford that the biological opinion would be issued during March 2008.

This biological opinion is based primarily on information contained in the following documents:

(1) "*Los Trancos Creek Fish Ladder Facility Modifications, Preliminary Design Criteria*" prepared by Wood Rodgers, Inc. dated April 13, 2004.

(2) "*Biological Surveys for Steelhead Passage and Habitat Quality on Los Trancos Creek, 2003 - 2005*" prepared by Carmen Ecological Consulting, dated June 2005.

(3) Pre-Construction notification and nationwide permit application for the Steelhead Habitat Enhancement Project, prepared by Olberding Environmental, Inc., dated October 2005.

(4) "*Steelhead Trout Biological Assessment*", prepared by Olberding Environmental, Inc. dated November 2005.

(5) "*An Assessment of Bypass Flows to Protect Steelhead below Stanford University's Water Diversion Facilities on Los Trancos Creek and San Francisquito Creek*" prepared by NMFS, dated February 15, 2006.

(6) Stanford's "*SHEP Proposed Project Modifications and Operations & Maintenance Plan*", dated July 6, 2006.

(7) "*Wetland and Riparian Mitigation and Monitoring Plan for Permanent Impacts*", by Olberding Environmental Inc. dated September 2006.

(8) Design drawings and specifications for "*San Francisquito Creek Pump Station Capacity Upgrade Improvements*" prepared by Wood Rodgers, Inc. dated February 12, 2007.

(9) "*Biological Impact Minimization Plan*", prepared by Olberding Environmental, Inc., dated October 2007.

(10) "*Wetland and Riparian Restoration and Monitoring Plan for Temporary Impacts*", prepared by Olberding Environmental Inc. dated October 2007.

II. DESCRIPTION OF PROPOSED ACTION

The Corps proposes to issue a permit under Section 404 of the Clean Water Act (CWA) to Stanford to implement structural, mechanical, electrical, and site work improvements to the Los Trancos Diversion on Los Trancos Creek, and San Francisquito Pump Station on San Francisquito Creek. Both sites have existing water diversion facilities owned and operated by Stanford. The project sites are on: (1) Los Trancos Creek near the community of Portola Valley, and (2) San Francisquito Creek adjacent to Stanford University Golf Course on the border of San

Mateo and Santa Clara counties, California (Corps File No. 28630S) (Figure 1). Construction of these projects will be completed between June 15 and October 15, 2008, or June 15 and October 15, 2009, pending receipt of all necessary approvals.

Stanford exercises appropriative and riparian water rights to divert water from Los Trancos Creek and from San Francisquito Creek, and has exercised these water rights for more than a century. Diverted water is used primarily for irrigation of the campus golf course, athletic fields, and campus landscaping, as well as for environmental, recreational, aesthetic and groundwater recharge purposes on campus. The Los Trancos Creek Fish Ladder and Diversion Facility diverts water from Los Trancos Creek to nearby Felt Reservoir, never exceeding 40 cubic feet per second (cfs) in diversion rate. Stanford installed a fish screen and fish ladder and increased bypass flows at the Los Trancos Creek Diversion Facility in 1995. The San Francisquito Pump Station draws water from San Francisquito Creek into the campus water supply system through two pairs of pumps (four pumps in total) and an intake gallery. Each pair of pumps currently has a 4 cfs capacity.

Following the construction of the 1995 fish passage facilities, Stanford has experienced many problems with the screen and brush mechanisms at the mouth of the Felt Lake diversion flume. The configuration of the bypass channel, diversion flume, fish screen, and the ladder results in inefficient water diversion during medium and high creek flows because the water does not back up properly against the screen and flume entrance. Frequent clogging of the screen further exacerbates loss of diversion flow to the flume. To address the existing facility deficiencies, fish bypass flow issues raised by CDFG, and the 1997 listing of steelhead as a threatened species by NMFS, Stanford has proposed the SHEP. The SHEP would implement additional structural and operational measures to enhance creek conditions for steelhead while preserving Stanford's ability to meet its water supply needs. The two equal objectives of the Project are: (1) to improve the design of the existing fish passage facilities to further enhance passage conditions, and (2) to improve the efficiency and operational capabilities of Stanford's diversion facilities to accommodate increased bypass flows in Los Trancos and San Francisquito creeks while minimizing adverse effects to Stanford's water supply.

The primary components of the SHEP include:

(1) Reconfiguring of the Los Trancos Diversion Facility with mechanized flow-regulating gates for the flume, replacement of the facility's Alaskan Steeppass fish ladder with a continuously operating step-pool and weir facility, and replacement/modernization of the water intake's fish screen;
(2) Adding a surface intake screen and an additional 4 cfs pump to the San Francisquito Creek Pump Station;
(3) Increasing the minimum bypass flow rates in Los Trancos Creek and San Francisquito Creek below both water diversion facilities; and
(4) Excavating accumulated sediment in Felt Reservoir to restore its original capacity.

A. Description of Proposed Project Design and Construction Work

1. Proposed Modifications at Los Trancos Diversion/Ladder Facility

The SHEP involves modifications to the design of the current fish ladder and fish screen, such that Stanford can more efficiently divert water. The Project also improves the efficiency and performance of the fish passage components, by consolidating the bypass function with the fish ladder into one fishway. The proposed Los Trancos Creek Fish Ladder Facility modifications are described in the preliminary design report by Wood Rodgers, Inc. dated April 13, 2004 (Wood Rodgers, Inc. 2004). The proposed modifications include:

(1) removing from service the existing fish screen cleaning system and fish ladder;

(2) grout-filling and abandoning in place the existing bypass channel;

(3) installing a new pool-and-weir fishway that will operate continuously (except during short maintenance periods in the summer);

(4) installing a new diversion control structure;

(5) modifying the fish screen; and

(6) installing a local control station.

The reconfiguration of the facility and added components, including the control structure, will back the water up higher against the screens, which will improve the efficiency of the diversion and reduce debris clogging of the screens. The existing dam, radial gate, flume, and access structure will be preserved in place. Flow measurement devices will be installed in the diversion facility to facilitate controls and operation. The physical and operational modifications to the Los Trancos Diversion facility will rely on the use of modern electro-mechanical equipment and automated control mechanisms to regulate diversions and bypass flows according to project's *Operations and Bypass Procedure* described below (section II.B.).

The new fishway has been designed to comply with current CDFG and NMFS criteria for anadromous fish passage, and will be installed into the existing berm between the creek and flume. The fish screen modifications and proposed screen cleaning mechanism will also conform to current CDFG and NMFS criteria. The new diversion control structure, fishway slide gate, and automated control mechanisms will be installed and configured such that the diverted flow and bypass flow can be controlled as a function of total creek flow. Creek flow will be routed either through the new fishway, through the existing radial gate spillway structure, over the existing dam, or diverted through the modified fish screen structure and into Stanford's conveyance system to Felt Reservoir. The proposed modifications will facilitate and improve operations and enhance fish passage conditions during periods of low and high creek flows.

2. Proposed Modifications at San Francisquito Creek Pump Station

Proposed improvements at the San Francisquito Pump Station facility downstream of the Los Trancos Diversion/Ladder Facility will allow Stanford to capture a portion of the water bypassed at the Los Trancos facility. The existing San Francisquito Pump Station was constructed in 1998 and is located in San Francisquito Creek, just over one mile below the confluence of Los Trancos and San Francisquito creeks. The existing pump station consists of two pairs of pumps: one pair for the Lagunita diversion, and a second pair of pumps to supply water for Felt Lake. The Lagunita is an off-channel seasonal reservoir on the Stanford Campus. Each pair of pumps in the current station has a capacity of 4 cfs. The pumps have been operated one pair at a time, but not simultaneously, because of limitations of the intake system and the usually low creek flow rate in the spring when the Lagunita diversions are generally needed.

The SHEP's proposed San Francisquito Pump Station improvements will facilitate capture of the increased bypass flows at the modified Los Trancos Creek Diversion facility. The capacity of the San Francisquito Pump Station's "Felt pumps" will be increased from a current 4 cfs capacity to 8 cfs. This flow rate is the maximum rate that can be accommodated in the existing pipeline between the station and Felt Reservoir. The pumps used to divert water to the Lagunita will not be changed. The proposed modifications include:

(1) Adding a new 4-cfs pump/motor in a new vault immediately upstream of the existing pump vault (the existing two 2-cfs pumps will remain as they are);
(2) Upsizing of the entire electrical service and system to serve the new larger pump/motor;
(3) Adding a 12-cfs capacity surface intake system, properly screened, in order to provide additional and more reliable intake capacity to the pumps;
(4) Installing rock spurs upstream of the pump station, to guide and stabilize creek flow to the intake gallery and fish screens, where it was prior to the construction of the current pump station;
(5) Raising of the pump vault lids above the low flow water level (for maintenance access); and
(6) Installing a creek flow measuring device, so that diversions can be regulated with respect to flow.

3. Proposed Minimization Measures for Construction on Los Trancos and San Francisquito creeks

The October 2007 Biological Impacts Minimization Plan for the SHEP proposes the following general measures to avoid and minimize impacts to the aquatic environment during construction at both the Los Trancos and San Francisquito water diversion facilities:

(1) Project activities that may affect stream channels or banks will be scheduled no earlier than June 15 and will end by October 15. Temporary instream structures will be removed by October 15.

(2) Biologists will monitor construction activities associated with the project on a daily basis.

(3) All sandbags, plastic, and construction materials and equipment will be removed from construction sites upon project completion.

(4) Equipment will be maintained in good working order to prevent the leakage and spillage of hazardous materials into the watercourse.

(5) All concrete structures will be isolated from the flowing stream until fully cured. Application of a water-base concrete sealer after a period of time will be applied to reduce the isolation time of the concrete from the stream.

(6) Erosion control and sediment detention devices will be implemented at the time of construction for the purpose of minimizing fine sediment and sediment/water slurry input to the creek.

(7) Erosion control measures including natural fiber matting, hydroseeding with native vegetation and replanting will be utilized in order to prevent streambank erosion after project construction.

(8) If riparian vegetation must be removed, replanting of riparian vegetation will replace lost habitat at a 3:1 ratio on an area basis. Maintenance of re-vegetated sites will continue for at least three growing seasons.

(9) In channel work areas will be isolated from the live stream by installing a cofferdam and bypassing water past the work site through a pipe.

(10) A qualified fisheries biologist will be hired to monitor project areas and for removing and relocating fish from areas dewatered for construction. Use of electrofishing equipment for fish collection will comply with NMFS guidelines. Fish will be relocated to pools safely outside of the construction area.

(11) Diversion dams will be constructed with sand bags and washed gravels at least 0.5 inches in diameter. Cofferdam installation and removal will take place by hand.

(12) During construction all available streamflow will be allowed to pass downstream to maintain aquatic life.

4. Proposed Maintenance Excavation at Felt Reservoir

A component of SHEP includes restoration of the original storage capacity at Felt Reservoir on the Stanford Campus. Deposition of sediment in the reservoir has reduced its storage capacity by nearly 100 acre-feet. Stanford proposes to drain Felt Lake during the summer months and then excavate accumulated sediment using a scoop and lift approach. Excavated material will be placed in upland borrow pits and in an area several hundred yards north of the Felt Reservoir (Paddock Area).

Felt Reservoir is located at the terminus of the Felt Lake Diversion Canal and has no natural connection to Los Trancos Creek or San Francisquito Creek. Steelhead are not present in this lake and the site is not designated critical habitat. The water drained from the lake will not enter

Los Trancos or San Francisquito creeks. Therefore, the proposed maintenance excavation of Felt Reservoir is not discussed further in this biological opinion.

B. Operations and Bypass Procedures

In collaboration with CDFG and NMFS, Stanford has developed an operations plan which includes fish bypass flows (Operations and Bypass Procedure). The Operations and Bypass Procedure is proposed by Stanford as measures to protect steelhead and other aquatic species downstream of its water intake facilities. The Operation and Bypass Procedure for the Los Trancos Creek Diversion and San Francisquito Pump Station are presented below. Stanford proposes to operate to this plan immediately following the conclusion of construction and will continue in this manner in future years.

1. <u>Los Trancos Creek Fish Ladder and Diversion Facility</u>

Stanford proposes to operate the modified Los Trancos Diversion facility as follows:

a) Stanford will not divert from Los Trancos Creek, under any basis of right, between May 1 and November 30.
b) Diversions at the Los Trancos Creek diversion facility will be limited to the period between December 1 and April 30, as follows:
   i) The maximum instantaneous diversion rate will be limited to 40 cfs, less the simultaneous rate of flow diverted at the San Francisquito Creek facility.
   ii) Beginning December 1, the instantaneous bypass will not be less than 2 cfs (or natural flow, if less than 2 cfs).
   iii) Beginning January 1, or earlier if the "trigger" event described in paragraph c (below) occurs prior to January 1, the instantaneous bypass flows will not be less than 5 cfs (or natural flow, if less than 5 cfs) when creek flow upstream of the facility is less than 8 cfs, and will be 8 cfs when creek flow upstream of the facility is equal to or greater than 8 cfs for two hours.
c) The "trigger" event for flows described in paragraph b.iii (above) occurs when the mean daily (*i.e.*, calendar day) creek flow above the Los Trancos creek diversion facility is 8 cfs or more at any time after October 1.

2. <u>San Francisquito Pump Station</u>

Stanford proposes to operate the modified San Francisquito Pump Station facility as follows:

a) Stanford will not divert from the San Francisquito Pump Station, under any basis of right, from July 1 through November 30.
b) Consistent with paragraph c (below), the maximum instantaneous rate of diversion at the San Francisquito Pump Station (whether to the Felt Lake/campus distribution system, to Lagunita, or to both systems simultaneously) will not exceed 8 cfs.

i) The maximum instantaneous rate of diversion to Lagunita will not exceed 4 cfs.

ii) From December 1 through April 30, Stanford may divert up to 8 cfs at the San Francisquito Pump Station, even if the instantaneous diversion amount is greater than the flows simultaneously bypassed at the Los Trancos Creek Diversion facility, provided that the combined instantaneous diversions at the San Francisquito Pump Station and the Los Trancos Creek Diversion facility do not exceed 40 cfs.

c) From December 1 through June 30, the instantaneous bypass flows and the maximum instantaneous rate of diversion at the San Francisquito Pump Station will be as described in Table 1.

Table 1: Diversion rates proposed at the San Francisquito Pump Station. Q_{SF} is the abbreviation for flow, in cubic feet per second (cfs), in San Francisquito Creek above the pumping plan.

Q_{SF} cfs	Diversion cfs
0 - 5	0
6	1
7	2
8	3
9	4
10	5
11	6
12-16	0
17	1
18	2
19	3
20	4
21	5
22	6
23	7
24-33	8
34-40	0[a]
41-46	4[a]
47+	8

[a] Max diversion rate could be increased to 8 cfs over this range of flow if the Bonde Weir is modified to successfully and efficiently pass adult steelhead at flows of 16 to 100 cfs. (Modification of the Bonde Weir is not included in the SHEP.)

C. Maintenance of Modified Facilities

Each of the modified diversion facilities will require routine maintenance for on-going operation. The Corps proposes that the permit issued for construction of the SHEP also provide for the routine maintenance efforts for each facility described below. On-going maintenance activities will not require subsequent permitting by the Corps unless substantial construction of additional or new facilities or major components is contemplated. Except as necessary for continued diversion operation, all such maintenance work will be performed in the summer low flow periods.

1. Los Trancos Fish Ladder and Diversion Facility

For the Los Trancos Fish Ladder and Diversion facility, maintenance efforts will include periodic gravel removal from the ladder, inspections and maintenance of the gates and brush mechanisms and screens, and repairs of the concrete structures. Prior to any work in the creek's flow path, if fish are observed a qualified fisheries biologist will capture any fish using small seines or dip nets, and the fish will be relocated to an area downstream of the bypass. Typically, ladder access for sediment removal or repairs will be accomplished by the redirection of flow through the radial gate, and removal of the cover grates and opening of clean-out ports in the bottom of the baffles, or hand clearing of accumulated sediment and other materials. Following large storms, accumulated gravel in the flume/ladder entry area will be removed as necessary by opening the radial gate and shoveling the material over the dam, for distribution by the stream flow during a subsequent high flow event. Any necessary concrete repairs will be made in a manner ensuring that fish are not exposed to uncured concrete.

2. San Francisquito Creek Pump Station Facility

For the San Francisquito Pump Station facility, maintenance efforts will include periodic inspection, repair and replacement of the pumps, screens, flow measurement devices, concrete structures, gravel removal from the vaults, and possible adjustment of the bendway weirs. The raising of the pump vault covers above the low creek water level will occur during construction of the SHEP. This will facilitate access to the pumps and vaults without entering the live stream. Also, slots and boards inside the new fish screens can be accessed without creek water entering the vaults. However, should access to the screens from the creek be necessary, and prior to any work being done, if fish are observed a qualified fisheries biologist will collect any fish using small seines or dip nets, and the fish will be relocated downstream of the bypass. If vegetation on the stream bank is disturbed by maintenance activities, areas will be re-vegetated in accordance with the temporary impacts re-vegetation plan associated with the SHEP work.

D. Action Area

The action area is defined as all areas affected directly or indirectly by the Federal action (50 CFR 402.02). The location of Stanford's SHEP is within the San Francisquito Creek watershed on Los Trancos and San Francisquito creeks in Santa Clara and San Mateo counties, California (Figure 1.). For the purposes of this consultation, the action area encompasses Stanford's facilities on San Francisquito Creek, Los Trancos Creek, and the stream reaches affected by operation of these water diversion facilities. Thus, the action area includes one contiguous reach of stream comprised of: (1) approximately 2.3 miles of Los Trancos Creek extending from the Los Trancos Diversion facility downstream to the confluence with San Francisquito Creek; and (2) approximately 8.3 miles of San Francisquito Creek extending from the confluence with Los Trancos Creek downstream to San Francisco Bay. Stanford's San Francisquito Pump Station Facility is located on San Francisquito Creek approximately one mile downstream of the confluence with Los Trancos Creek.

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

This biological opinion analyzes the effects on Central California Coast (CCC) steelhead Distinct Population Segment (DPS) associated with Stanford's proposed modification and operation of two existing facilities located on Los Trancos and San Francisquito creeks. CCC steelhead are listed as threatened under the ESA, as amended (January 5, 2006, 71 FR 834). The CCC steelhead DPS includes steelhead in coastal California streams from the Russian River to Aptos Creek, and the drainages of Suisun Bay, San Pablo Bay, and San Francisco Bay. In addition, this biological opinion analyzes the effects on designated critical habitat for threatened CCC steelhead (September 2, 2005; 70 FR 52488). Los Trancos and San Francisquito creeks are designated critical habitat for CCC steelhead.

A. Species Description and Life History

Steelhead are anadromous fish, spending some time in both fresh- and saltwater. The older juvenile and adult life stages occur in the ocean, until the adults ascend freshwater streams to spawn. Eggs (laid in gravel nests called redds), alevins (gravel dwelling hatchlings), fry (juveniles newly emerged from stream gravels), and young juveniles all rear in freshwater until they become large enough to migrate to the ocean to finish rearing and maturing to adults. General reviews for steelhead in California document much variation in life history (Shapovalov and Taft 1954, Barnhart 1986, Busby *et al.* 1996, McEwan 2001). Although variation occurs in coastal California, steelhead usually live in freshwater for 1 to 2 years in central California, then spend 2 or 3 years in the ocean before returning to their natal stream to spawn. Steelhead may spawn 1 to 4 times over their life. Adult steelhead which originate from the San Francisquito Creek watershed typically immigrate from the ocean to freshwater between December and April, peaking in January and February, and juveniles migrate as smolts to the ocean from January through June, with peak emigration occurring in April and May (Fukushima and Lesh 1998). Given the proposed construction period between June 15 and October 15, only juvenile steelhead are likely to be present in the action area during construction. However, all steelhead life stages (adults, eggs, fry, juveniles, and smolts) can be present during the year-round operation of Stanford's water diversion facilities on Los Trancos and San Francisquito creeks.

Steelhead fry rear in edgewater habitats and move gradually into pools and riffles as they grow larger. Cover is an important habitat component for juvenile steelhead, both as a velocity refuge and as a means of avoiding predation (Shirvell 1990, Meehan and Bjornn 1991). Steelhead, however, tend to use riffles and other habitats not strongly associated with cover during summer rearing more than other salmonids. Young steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles. Rearing steelhead juveniles prefer water temperatures of 7.2-14.4 degrees Celsius (°C) and have an upper lethal limit of 23.9°C (Barnhart 1986, Bjornn and Reiser 1991). They can survive in water up to 27°C with saturated dissolved oxygen conditions and a plentiful food supply. Fluctuating diurnal water temperatures also aid in survivability of salmonids (Busby *et al.* 1996). Juvenile steelhead emigrate episodically from natal streams during fall, winter, and spring high flows, to the ocean to continue rearing to maturity.

Adults returning to spawn may migrate several miles, hundreds of miles in some watersheds, to reach their natal streams. Although spawning typically occurs between January and May, the specific timing of spawning may vary a month or more among streams within a region, and within streams interannually. Spawning (and smolt emigration) may continue through June (Busby *et al.* 1996). Female steelhead dig a nest in the stream and then deposit their eggs. After fertilization by the male, the female covers the nest with a layer of gravel. Steelhead do not necessarily die after spawning and may return to the ocean, sometimes repeating their spawning migration one or more years. The embryos incubate within the nest. Hatching time varies from about three weeks to two months depending on water temperature. The young fish emerge from the nest about two to six weeks after hatching.

B. Status of Species

Historically, approximately 48 populations[1] of steelhead existed in the CCC steelhead DPS (Bjorkstedt *et al.* 2005). Many of these populations (about 20) were independent, or potentially independent, meaning they had a high likelihood of surviving for 100 years absent anthropogenic impacts. The remaining populations were dependent upon immigration from nearby CCC steelhead DPS populations to ensure their viability (Bjorkstedt *et al.* 2005, McElhaney *et al.* 2000).

While historical and present data on abundance are limited, CCC steelhead numbers are substantially reduced from historical levels. A total of 94,000 adult steelhead were estimated to spawn in the rivers of this DPS in the mid-1960s, including 50,000 fish in the Russian River - the largest population within the DPS (Busby *et al.* 1996). Recent estimates for the Russian River are on the order of 4,000 fish (NMFS 1997). Abundance estimates for smaller coastal streams in the DPS indicate low but stable levels with recent estimates for several streams (Lagunitas,

[1] Population as defined by Bjorkstedt *et al.* 2005 and McElhaney *et al.* 2000 as, in brief summary, a group of fish of the same species that spawns in a particular locality at a particular season and does not interbreed substantially with fish from any other group. Such fish groups may include more than one stream. These authors use this definition as a starting point from which they define four types of populations (not all of which are mentioned here).

Waddell, Scott, San Vincente, Soquel, and Aptos creeks) of individual run sizes of 500 fish or less (62 FR 43937). For more detailed information on trends in CCC steelhead abundance, see: Busby *et al.* 1996, NMFS 1997, and Good *et al.* 2005.

Some loss of genetic diversity has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt *et al.* 2005). Reduced population sizes and fragmentation of habitat in Central California coastal streams has likely also led to loss of genetic diversity in these populations.

CCC steelhead have experienced serious declines in abundance and long-term population trends suggest a negative growth rate. This indicates the DPS may not be viable in the long term. DPS populations that historically provided enough steelhead immigrants to support dependent populations may no longer be able to do so, placing dependent populations at increased risk of extirpation. However, because CCC steelhead have maintained a wide distribution throughout the DPS, roughly approximating the known historical distribution, CCC steelhead likely possess a resilience that is likely to slow their decline relative to other salmonid species in worse condition. The most recent status review concludes that steelhead in the CCC steelhead DPS remain "likely to become endangered in the foreseeable future" (Good *et al.* 2005). On January 5, 2006, NMFS issued a final determination that the CCC steelhead DPS is a threatened species, as previously listed (71 FR 834).

C. Status of Critical Habitat

The condition of CCC steelhead critical habitat, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. NMFS has determined that present depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat[2]: logging, agricultural and mining activities, urbanization, stream channelization, dams, wetland loss, and water withdrawals, including unscreened diversions for irrigation. Impacts of concern include alteration of stream bank and channel morphology, alteration of water temperatures, loss of spawning and rearing habitat, fragmentation of habitat, loss of downstream recruitment of spawning gravels and large woody debris, degradation of water quality, removal of riparian vegetation resulting in increased stream bank erosion, increases in erosion entry to streams from upland areas, loss of shade (higher water temperatures) and loss of nutrient inputs (Busby *et al.* 1996, 70 FR 52488). Depletion and storage of natural river and stream flows have drastically altered natural hydrologic cycles in many of the streams in the DPS. Alteration of flows results in migration delays, loss of suitable habitat due to dewatering and blockage; stranding of fish from rapid flow fluctuations; entrainment of juveniles into poorly screened or unscreened diversions, and increased water temperatures harmful to salmonids.

[2] Other factors, such as over fishing and artificial propagation, have also contributed to the current population status of these species. All these human induced factors have exacerbated the adverse effects of natural environmental variability from such factors as drought and poor ocean conditions.

As part of the critical habitat designation process, NMFS created Critical Habitat Analytical Review Teams (CHART) to describe and assess potential critical habitat for several salmonid populations including, among others, CCC steelhead.[3] Conservation values of "high", "medium", and "low", were determined from a variety of data sources on quality, quantity, and distribution of physical or biological features associated with spawning, rearing, and migration. Because quality of habitat was only one of the rating factors used to determine conservation value, and habitat quality was considered at a relatively large geographic scale, specific stream reaches within any given area may, or may not, contain high quality of habitat, regardless of the area's overall rating for conservation value. The assessment for the CCC steelhead DPS was divided into ten CALWATER Hydrologic Units (HU). The Santa Clara Subbasin HU includes several small watersheds draining into south San Francisco Bay. The Santa Clara Subbasin HU is divided into five hydrologic subareas (HSA); San Francisquito and Los Trancos creeks are included in the Palo Alto HSA. The Palo Alto HSA has a medium conservation value for CCC steelhead critical habitat (NMFS 2005).

IV. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species in the action area. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR §402.02).

For the purposes of this consultation, the action area encompasses approximately 2.3 miles of Los Trancos Creek extending from the Los Trancos Diversion facility downstream to the confluence with San Francisquito Creek, and approximately 8.3 miles of San Francisquito Creek extending from the confluence with Los Trancos Creek downstream to San Francisco Bay. These reaches are contiguous and represent the stream reaches affected by Stanford's water diversion operations.

A. Action Area Overview

The San Francisquito Creek watershed is located on the San Francisco Peninsula, and includes portions of both San Mateo and Santa Clara counties. The watershed is approximately 45 square miles, extending from the ridge of the Santa Cruz Mountains to San Francisco Bay. The climate is Mediterranean, with over 90 percent of annual precipitation occurring between November and April. Cool, moist coastal fog generally alternates with clear, warm weather during the months

3 Final assessment of the National Marine Fisheries Service's Critical Habitat Analytical Review Team seven salmon and steelhead Evolutionarily Significant Units in California. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. 23 pages plus appendixes.

of May through September, and significant rainfall during that time is rare. The watershed includes a diversity of urban, rural, and natural habitats. Headwater areas are located in protected open space preserves, with residential and commercial development of moderate density predominating at lower elevations.

San Francisquito Creek and its tributaries, including Los Trancos Creek, is one of two San Mateo County watersheds on the west side of San Francisco Bay with an anadromous population of CCC steelhead. San Mateo Creek to the north is thought to support a remnant population of steelhead, but information regarding this population is lacking. Although passage obstacles exist within the San Francisquito watershed, excellent spawning and rearing habitat is present in the upper reaches. High quality habitat in the larger tributaries of the upper watershed supports the spawning and rearing of steelhead. Flows within the watershed are highly variable and can go quickly from low base flow conditions to high flows and then quickly recede again. Flows range from several hundred cfs during and immediately following winter storm events, to less than 1 cfs during most summers. Portions of the watershed, including Los Trancos Creek, can run dry in late summer and in fall.

Dry conditions in the late summer and fall may be exacerbated in the future due to global climate change. The acceptance of global climate change as a scientifically valid and anthropogenic driven phenomenon has been well established by the United Nations Framework Convention on Climate Change (UNFCCC), the Intergovernmental Panel on Climate Change, and others (Davies et al. 2001, Walther et al. 2002, UNFCCC 2006). Global climate change is likely to manifest itself differently in different regions. One impact predicted for California by the California Energy Commission is an increase in critically dry years (Cayan et al. 2006). Many of the threats already identified for salmonid populations are related to a reduction in surface flow of tributary streams. Future climate change may therefore substantially increase risk to the species by exacerbating dry conditions.

Specific information regarding the species abundance within San Francisquito Creek watershed is incomplete. In the late 19th and early 20th centuries, upper watershed tributaries (*i.e.*, Bear Creek) were home to a steelhead sport fishing industry (San Francisquito Coordinated Resource and Management Plan 2001). Stanford's Conservation Biology Center has conducted fisheries sampling throughout the watershed in recent years and confirmed the presence of steelhead and their distribution throughout the watershed (Smith and Hardin 2001).

B. Status of Steelhead and Critical Habitat in the Los Trancos and San Francisquito Creeks Action Area

1. <u>Los Trancos Creek</u>

Los Trancos Creek is one of three major tributaries entering the free flowing section of San Francisquito Creek downstream of Searsville Dam. An approximately eight mile long stream with a roughly 7.6 square mile watershed, Los Trancos Creek is the boundary between San

Mateo and Santa Clara counties. Carmen and White (2004) summarize existing information and data concerning the steelhead run in Los Trancos Creek. Fish studies have been conducted on Los Trancos Creek since the 1970s, but the surveys performed by CDFG in 1992 and 1993 (Anderson 1995) provide the most information regarding steelhead abundance. In the summer of 1993, Anderson (1995) found several age classes of steelhead above and below Stanford's Los Trancos Diversion facility. Sampling performed by Stanford University in August 1998 and 1999 found abundant steelhead throughout Los Trancos Creek (Launer and Holtgrieve 2000). Vogel (2000) performed snorkel surveys in Los Trancos Creek and observed abundant numbers of steelhead juveniles. Santa Clara Valley Water District (SCVWD) (2004) reports information concerning steelhead spawning habitat in Los Trancos Creek and identified many factors in the watershed that could limit steelhead productivity. Surveys performed by SCVWD in March and April 2003 found "relatively healthy" numbers of steelhead (SCVWD 2004). Recent surveys of Los Trancos Creek were performed by Carmen Ecological Consulting on behalf of Stanford University in 2003, 2004, and 2005. Carmen's surveys found numerous steelhead from all life stages and they observed redds paired with adults downstream of the Los Trancos Diversion (Carmen and White 2005).

Instream habitat conditions in the action area of Los Trancos Creek are generally good to excellent. Although habitat quality is diminished by the lack of large woody debris and low/dry flow conditions during the summer and fall, small and medium size pools provide high quality habitat for juvenile steelhead. Riffles and runs are generally comprised of streambed materials that are of sufficient size for quality spawning and rearing. Instream cover is provided by small boulders, large cobbles, undercut banks, woody debris, and riparian vegetation. The creek is moderately well shaded by an overstory of second growth redwoods, alder, and bay trees. Overwinter habitat conditions may be limited by the presence of few secondary channels and backwater areas, but other features such as small boulders and undercut banks provide some refugia from high velocity flow events. Available information indicates Los Trancos Creek provides high quality spawning and rearing habitat for steelhead in the action area. Based on current channel conditions, designated critical habitat within the action area is slightly degraded from properly functioning condition due to low flow conditions created by water withdrawals, bank stabilization, and fish passage impediments.

2. San Francisquito Creek

Little information is available regarding steelhead on the mainstem of San Francisquito. In June, August, and September 2004, steelhead were collected at two locations in San Francisquito Creek associated with the construction of the Sand Hill Road bridge project and the removal of an instream golf cart crossing (Alley 2004). The Sand Hill Road bridge site is located immediately downstream of Stanford's San Francisquito Pump Station while the golf cart crossing is immediately upstream of the pump station. Young-of-the-year and yearling steelhead were collected at both sites throughout the summer of 2004 (Alley 2004).

Adult steelhead migrate up San Francisquito Creek to access its tributaries during the winter season. Spawning is known to occur in the tributaries, but has not been observed within the mainstem of San Francisquito Creek. Adjacent land uses along the 8.3 miles reach of San Francisquito Creek in the action area include commercial and residential development, Stanford University facilities, Stanford University Golf Course, and numerous road crossings. The San Francisquito Pump Station is located on San Francisquito Creek adjacent to the Stanford University Golf Course. Native and non-native riparian trees and herbaceous vegetation are present along the banks of the creek. Portions of the San Francisquito Creek action area have been engineered or channelized, while other areas are in a semi-natural state. Smith and Harden (2001) identified five principal artificial barriers to steelhead passage on San Francisquito Creek.

C. Factors Affecting the Species Environment and Critical Habitat in the Action Area

Primary constituent elements (PCEs) of designated critical habitat for CCC steelhead in the action area of Los Trancos and San Francisquito creeks include water quality and quantity, foraging habitat, natural cover including large substrate and aquatic vegetation, and migratory corridors free of obstructions. Within Los Trancos Creek, PCEs are slightly degraded. Residential land use and Stanford campus development have resulted in non-point source pollutant contamination, removal of riparian vegetation, and construction of road crossings, and other fish passage impediments. Bank erosion has been stabilized with rip-rap, concrete walls, and other materials. On San Francisquito Creek, PCEs of designated critical habitat are moderately degraded. Stanford's golf course, campus academic facilities, residential development, commercial development, roadways, and engineered channels for flood control have resulted in non-point source pollution, fish passage impediments, loss of riparian vegetation and loss of instream habitat complexity and diversity.

1. Los Trancos

The Los Trancos Fish Ladder and Diversion are located on Los Trancos Creek approximately 2.3 miles upstream from the confluence with San Francisquito Creek. Winter flows range from over 200 cfs average per day following storm events while summer flows average less than 1 cfs and surface flow may cease in some reaches during some summer months (Carmen and White 2005). Stanford currently operates the Los Trancos Diversion at a maximum intake rate of 40 cfs between December 1 and April 31. Up to 900 acre feet of water may be diverted annually by Stanford at this location under water right License No. 1732. Under current operations, Stanford's operational procedure is to bypass 0.5 cfs prior to initial storms. After an initial storm event and subsequent storms, Stanford's bypass procedure is to release 5 cfs for two consecutive days and then provide a flow of 1 cfs. The existing Alaskan Steeppass ladder does not function until Los Trancos Creek flows exceed 3 cfs. In combination with current water diversion operations, the existing fish ladder precludes the upstream passage of adult steelhead for extended periods under most winter and spring base flow conditions.

Water withdrawal at Stanford's Los Trancos Diversion has adversely affected aquatic habitat conditions in the action area. The Los Trancos Diversion Dam was a significant fish passage impediment until a fish ladder and fish screen were constructed in 1995. This existing structure consists of a large concrete dam positioned across the channel of Los Trancos Creek. Water is diverted at the dam by gravity from Los Trancos Creek into the Felt Lake Diversion Canal. The Felt Lake Diversion Canal is a constructed concrete lined flume which allows water to be diverted to Felt Reservoir approximately 3,000 feet to the northeast of the diversion dam. Creek flow not diverted into the diversion canal is bypassed downstream in Los Trancos Creek through a juvenile bypass structure, or through an existing metal fish ladder, or through an overflow structure. A shallow pool has formed in the creek at the base of the existing Los Trancos Diversion Dam.

Due to structural inefficiencies at the existing Los Trancos Diversion and fish screen facility, current bypass flows in Los Trancos Creek downstream of the water intake vary widely and frequently exceed the bypass rate of Stanford's operational procedure described above. The effects of Stanford's diversion on Los Trancos Creek has impacted steelhead migration, spawning, and incubation by reducing winter base flow volumes and reducing hydrologic peaks during light and moderate storm events. Flows for summer rearing have been unaffected by this diversion, because Stanford's water right precludes diversion from Los Trancos Creek between May and November of each year.

Aquatic habitat in Los Trancos Creek below Stanford's water intake has been moderately affected by human activities. Within the action area, Los Trancos Creek parallels Alpine Road and is primarily on the campus of Stanford University. Stanford has leased lands along the creek for use by plant nurseries and equestrian facilities, while other areas along side the creek contain campus facilities or remain as open space. Landscaping, equestrian facilities, fences, roadways, and other structures may be found in close proximately to the bank of Los Trancos Creek.

2. <u>San Francisquito Creek</u>

In the action area, San Francisquito Creek parallels the Stanford campus and runs through the cities of Palo Alto and Menlo Park to San Francisco Bay. Adjacent land uses in the action area include Stanford's golf course, campus academic facilities, residential development, commercial development, and roadways. Through the Stanford Golf Course, a narrow riparian corridor separates the creek from the fairways and greens. Downstream of campus, private residences and associated patios, and landscaping may be found in very close proximately to the creek. Roadways and commercial development also border the creek. Numerous locations along the bank and in-channel have been stabilized with rock riprap and concrete to minimize erosion and prevent the channel from moving laterally. Downstream of the San Francisquito Pump Station portions of the stream channel have been engineered or channelized for flood protection for the cities of Menlo Park and Palo Alto.

Stanford's San Francisquito Pump Plant facility is situated on the eastern bank of San Francisquito Creek and consists of four water pipes that extend from an intake gallery submerged in the bottom of the San Francisquito Creek channel. In the past, water withdrawal by Stanford at the San Francisquito Pump Station has generally been limited to low rates of diversion. The existing facility contains two sets of pumps. Each pair of pumps in the current station has a capacity of 4 cfs to make a combined total of 8 cfs, but the pump sets cannot be operated simultaneously due to limitations of the existing intake system. Under current operations, Stanford diverts at a maximum rate of 4 cfs from San Francisquito Creek from December 1 through June 30. The pump station's infiltration gallery did not function properly until 2004, as a result of sediment deposits along the inside of the bend in the creek atop the infiltration gallery. The San Francisquito Pump Station has affected aquatic habitat conditions downstream of the pump station by reducing stream flows for steelhead migration and rearing. The existing San Francisquito Pump Station has no bypass flow requirements for the protection of aquatic habitat downstream.

Several fish passage barriers exist in the action area of San Francisquito Creek. Smith and Hardin (2001) identified five barriers to upstream migration in San Francisquito Creek. The most significant barrier in the action area is a concrete weir across the stream near Alma Street in Menlo Park (known as the Bonde Weir). This weir consists of concrete sill that is 11 feet long and 45 feet wide. The weir structure is only between 2 and 3 feet high in elevation, but fish passage is difficult because stream flow spreads across the incline and it becomes very shallow for the entire 11-foot length. Suitable conditions for upstream fish passage over this facility are not available until creek flows exceed 35 cfs. The Bonde Weir has been the subject of investigations and considered for modification to minimize its impact to upstream fish movements. In March 2005, the San Francisco Bay Salmonid Habitat Restoration Fund granted $156,000 to the City of Menlo Park to design and remedy fish passage at this location. An additional $70,000 has been granted to Menlo Park by the NOAA Restoration Center for this project. Preliminary design plans for the Bonde Weir propose to modify the structure in a manner that will allow for upstream passage during San Francisquito Creek flows as low as 5 cfs (Howard 2007).

Upstream of the action area, water flows in San Francisquito Creek are impounded by Searsville Reservoir and Dam. Searsville Dam, which is owned and operated by Stanford, releases flow into San Francisquito Creek above the project action area. There is no fish passage facilities at Searsville Dam. Steelhead have not had upstream access to the watershed above Searsville Dam since the facility's construction in the 1890s. From Searsville Dam, the San Francisquito Creek flows approximately 12 miles to San Francisco Bay.

Bear Creek is a large tributary to San Francisquito Creek and its confluence is immediately downstream of Stanford's Searsville Dam. In Bear Creek watershed, the California Water Service operates two water diversion facilities. On Bear Gulch, California Water Service's Upper Diversion Dam diverts up to 12.4 cfs of streamflow year-round, while the Station 3 Pumping Plant on Bear Creek diverts up to 4.7 cfs during the winter and spring months. Under low flow conditions, the operation of these two California Water Service facilities under low flow conditions could reduce streamflow volumes arriving to San Francisquito Creek below Searsville Dam.

D. Previous Section 7 Consultations Affecting the Action Area

NMFS has completed informal consultations for bank stabilization and levee maintenance projects within the action area along San Francisquito Creek. NMFS completed a formal consultation with the Corps on May 26, 2004, regarding Stanford Management Company's replacement of the Sand Hill Road Bridge over San Francisquito Creek. Construction occurred in the summer and fall of 2004. Fish were collected and relocated in San Franciscquito Creek for the dewatering of the construction site and there was single mortality of a young-of-year steelhead. Approximately 81 juvenile steelhead were successfully collected and relocated to areas outside of the construction zone. The single mortality of a juvenile steelhead during construction of the Sand Hill Road bridge replacement is unlikely to affect the current steelhead population in the watershed and all other impacts associated with this project were temporary construction effects or beneficial. The Sand Hill Road Bridge project widened an existing bridge and improved the condition of steelhead migration habitat by removing a concrete low water crossing. No other formal consultations pursuant to section 7 of the Endangered Species Act (ESA) with NMFS have affected the action area.

V. EFFECTS OF THE ACTION

The project activities that are expected to affect steelhead and designated critical habitat include construction of the new fish screen and fish ladder on Los Trancos Creek, construction of the new fish screen and pump station facilities on San Francisquito Creek, and the operation of both water diversion facilities. Construction effects are expected to be limited to the period between June 15 and October 15 in 2008 or 2009. Only juvenile steelhead are anticipated to be in the action area during this construction period. Operation of the Los Trancos Diversion on Los Trancos Creek and the San Francisquito Pump Station on San Francisquito Creek will occur during the winter and spring months. Thus, all life stages of steelhead will be subject to the effects of the on-going operation of these water diversions, the new fish screens, and the new fish ladder.

A. Project Construction

1. <u>Fish Relocation Activities</u>

Fish collection and relocation will be performed in coordination with dewatering for construction purposes at both the Los Trancos Diversion and the San Francisquito Pump Station facilities. On Los Trancos Creek, the existing facility will be dewatered (approximately 40 linear feet) and an additional 50 feet of channel downstream of the existing facility will be dewatered to construct the new fishway. The temporary water diversion system on Los Trancos for construction purposes will consist of a cofferdam across the channel immediately upstream of the existing facility to shunt water into the existing Los Trancos Diversion Dam's intake system, down the Felt Lake Diversion Canal, and into a temporary trench for discharge back into Los Trancos Creek immediately downstream of the construction area. Before and during dewatering, juvenile steelhead and other fish will be collected by seines or backpack electrofisher and relocated to a suitable habitat either upstream or downstream of the project area. Electrofishing will be performed in conformance with NMFS and CDFG guidelines.

The number of steelhead that may be relocated from the Los Trancos Creek project site prior to construction may be estimated from observations in the large pool at the base of the existing diversion dam. Steelhead in this pool have not been enumerated, but observations indicate that juvenile steelhead representing several age classes are present. The 50-foot length of natural channel to be dewatered at this site includes this pool and a portion of the riffle/run area immediately downstream. Steelhead relocation activities will occur during the summer low-flow period after emigrating smolts have left and before adults have immigrated to the proposed project site. Therefore, NMFS expects the CCC steelhead that will be captured during relocation activities will be limited to pre-smolting juveniles. Although the reach to be dewatered is short, the reach includes an important large pool area. Based on visual observations by NMFS biologists and the quality of habitat, it is estimated that between 50 and 80 juvenile steelhead may be residing at the existing diversion dam structure and in the natural channel below. Therefore, NMFS estimates that up to 80 juvenile steelhead may be collected from the dam, pool, and channel during the dewatering of this site prior to construction.

At the San Francisquito Pump Station approximately 180 feet of stream channel will be dewatered for construction. A cofferdam will be installed upstream of the existing facility and a diversion pipeline will be used to convey the flow of San Francisquito Creek around the construction site. As on Los Trancos Creek, fish will be collected by seine or backpack electrofisher before and during dewatering. Fish will be relocated to a suitable area upstream or downstream of the construction site.

The results of fish relocation by the Sand Hill Road bridge replacement project provide information to estimate the number of steelhead that could be relocated at the San Francisquito Pump Station site prior to construction. At both the Sand Hill Road bridge site and the golf cart crossing site, approximately 40 juvenile steelhead per 100 linear feet of stream were collected by electrofishing in June and September 2004. These sites are in close proximately to the Pump Station construction site and habitat conditions are similar. Since the SHEP proposes to temporarily dewater approximately 180 linear feet of stream for construction, it is estimated that 80 to100 juvenile steelhead may be present in the San Francisquito Creek Pump Station construction zone prior to dewatering. As with the Los Trancos Creek construction site, steelhead relocation activities will occur during the summer low-flow period after emigrating smolts have left and before adults have immigrated to the proposed project site. Therefore, the CCC steelhead that will be captured during relocation activities will be limited to pre-smolting juveniles.

Fish relocation activities pose a risk of injury or mortality to rearing juvenile salmonids. Any fish collecting gear, whether passive (Hubert 1996) or active (Hayes *et al.* 1996) has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of unintentional injury and mortality attributable to fish capture varies widely, depending on the method used, the ambient conditions, and the expertise and experience of the field crew. Since fish relocation activities will be conducted by qualified fisheries biologists following both CDFG and NMFS guidelines, direct effects to and mortality of juvenile salmonids during capture will be minimized. Data from two years of similar salmonid relocation activities in Humboldt County indicate that average mortality rate is below one percent (Collins 2004). Those fish that avoid capture may be exposed to risks described in the following section on dewatering.

Although sites selected for relocating fish should have similar water temperature as the capture site and should have ample habitat, in some instances relocated fish may endure short-term stress from crowding at the relocation sites. Relocated fish may also have to compete with other fish causing increased competition for available resources such as food and habitat. Some of the fish released at the relocation sites may choose not to remain in these areas and move either upstream or downstream to areas that have more vacant habitat and a lower density of steelhead. As each fish moves, competition remains either localized to a small area or quickly diminishes as fish disperse. NMFS cannot accurately estimate the number of fish affected by competition, but does not believe this impact will adversely affect the survival chances of individual steelhead or cascade through the watershed population of these species based on the small area that will likely be affected and the small number of salmonids likely relocated.

2. Dewatering

Cofferdams will be placed upstream at both work sites to isolate the construction area from the live stream. On Los Trancos Creek, the dewatered area consists of the existing diversion dam facility and an additional 50 feet of natural channel downstream. On San Francisquito Creek, the dewatered area will extend approximately 180 feet at the existing Pump Station location. A bypass system will temporarily divert flow around the work sites. Thus, NMFS anticipates no changes in stream flow within and downstream of the project site during dewatering and construction activities. Stream flow in Los Trancos and San Francisquito creeks should be the same as free-flowing conditions except in the area actually dewatered. Overall dewatering is expected to cause minor, temporary loss, alteration, and reduction of aquatic habitat for several weeks during construction.

The temporary cofferdam structures in the creeks are not expected to impact juvenile steelhead movements. During the summer and fall, stream flow at all sites is typically low and may be intermittent in a dry year. The cofferdam isolation structure will restrict movement of juvenile steelhead in a manner similar to the seasonally normal isolation of pools by intermittent flow conditions.

Benthic (*i.e.*, bottom dwelling) aquatic macroinvertebrates within the project site may be killed or their abundance reduced when creek habitat is dewatered (Cushman 1985). However, effects to aquatic macroinvertebrates resulting from dewatering will be temporary because construction activities will be relatively short-lived, the dewatered reach is relatively small (up to 250 square feet) and rapid recolonization (about one to two months) of disturbed areas by macroinvertebrates is expected following rewatering (Cushman 1985, Thomas 1985, Harvey 1986). In addition, the effect of macroinvertebrate loss on juvenile salmonids is likely to be negligible because food from upstream sources (via drift) would be available downstream of the dewatered areas since stream flow, if present, will be bypassed around the project work site, and food sources derived from the riparian zone will not be affected by the project. Based on the foregoing, the loss of aquatic macroinvertebrates as a result of dewatering activities is not expected to adversely affect threatened CCC steelhead.

3. Increased Mobilization of Sediment in the Stream Channel and Water Quality

Dewatering will enable project construction to occur in the dry creek bed and minimize impacts to water quality during construction. During the subsequent winter's initial rainfall events, construction disturbance on the streambank can lead to increase sediment runoff into the creeks. The project plans for both sites will not leave any areas of exposed soil on the bank, however. So following construction, no soil erosion from the work sites is expected during the subsequent winter rainfall and storm events.

During construction, minor and temporary increases in turbidity may occur as the streambed is disturbed. However, turbidity levels are expected to be very low since the work site will be dewatered and the flow in Los Trancos and San Francisquito creeks is low during the summer and fall months. Construction sites will be fully dewatered. Thus, no vehicles or heavy equipment will enter the live stream channel. NMFS expects the minor and temporary disturbance in the channel could result in limited behavioral effects to steelhead juveniles due to construction noise and turbidity. Behavioral changes would primarily consist of temporarily vacating preferred habitat or temporarily reduced feeding efficiency. These behavioral changes are not expected to reduce the survival chances of individual salmonids in the action area.

When construction of the project is completed, re-watering of the work areas could allow the waters of the creeks to come into direct contact with wet or curing concrete. Concrete which has not completely dried may contaminate the waters of the creek by altering the pH. Wet or curing concrete can emit an alkali that is harmful to aquatic life. If concrete used during construction is not adequately cured and dried, the discharge to surface waters can elevate the pH of the creek and possibly result in aquatic life/fish kills. To address this issue, Stanford proposes to use curing agents and sealants which will allow for concrete to fully dry and cure prior to re-watering the site. This is expected to prevent the waters of Los Trancos and San Francisquito creeks from coming in direct contact with wet concrete. Alkali should not be released into the stream and pH in the creeks should not be affected when the site is re-watered.

B. Los Trancos Fish Ladder and Diversion Operation

1. <u>Operation of the New Fish Screen and Fish Ladder</u>

The new fish screen will prevent the entrainment and impingement of juvenile steelhead into the Felt Lake Diversion Canal. The screen is designed to provide an approach velocity of 0.33 cfs or less which will allow the smallest life stages of steelhead to freely swim away from the face of the screen (*i.e.*, avoid impingement). The screen will also have a mesh opening of 3/32 inch in diameter or less which will prevent steelhead from being entrained into the intake. The fish screens will be fully submerged, thereby reducing approaching water velocities and optimizing seasonal operation. Sweeping flows are expected to adequately provide for fish to continue to move past the facility under all streamflow conditions. Improved sweeping velocities are also anticipated to transport debris off the screens and prevent the accumulation of debris on the screens.

The new fish ladder design will consolidate the bypass function with the fish ladder into one fishway. The fishway will consist of a sloped, rectangular channel partitioned by weirs or baffles aligned perpendicular to the flow direction. Located at intervals of approximately five feet, the weir baffles will create a step-wise arrangement of resting pools for migrating steelhead. The fishway will be designed to dissipate the nine-foot head differential across the Los Trancos Diversion Dam by generating plunging flow at each pool and weir arrangement. The new fishway will have a total length of approximately 113 feet, thereby allowing for approximately 14 pool and weir arrangements. The fishway is designed to double back for approximately 38.5 feet before turning at a ninety-degree angle to allow for flows to drain into the pool that lies immediately downstream of the diversion dam. The weir heights are designed to allow for the upstream passage of both adult and juvenile steelhead.

With the new ladder and fish bypass flows (operations are discussed in detail below), adult steelhead will be able to pass upstream under a wide range of flow conditions. The new ladder is designed in conformance with NMFS fish passage guidelines and will provide suitable conditions for passage during base winter flow rates and during storm events to flows as high as 100 cfs. The new ladder will not provide suitable passage conditions during the hydrologic peak of a large storm event, but it is unlikely that steelhead adults will be ascending the stream under these conditions. Anadromous salmonids have adapted their migration patterns to minimize energy expenditure and they typically avoid the areas of fastest water by swimming nearshore or along the stream bottom (Quinn 2005). The majority of upstream steelhead migration is expected to occur before and following the hydrologic peak of storm events. Thus, the new fish ladder is expected to effectively pass adult steelhead upstream when the fish are actively migrating and delays to passage will be limited to no more than a few hours during the peak flow of the largest annual storm events.

In addition to adult passage, the fishway design and the year-round operation of the ladder will allow juvenile steelhead to pass from below the diversion dam to areas upstream of the dam.

Juvenile steelhead may move upstream or downstream during the summer and fall months in response to diminishing streamflows, increasing water temperatures, or territorial interactions with other individuals (Kahler *et al.* 2001). The new fishway's pool and weir arrangements will allow for juveniles to freely pass upstream and downstream under a wide range of flow conditions.

The project also includes the installation of a local master control station and stream gage station. The gage station in combination with the electro-mechanical controls will ensure water diversions, the fishway, fish screens, and fish bypass flows operate as designed. These devices will minimize the need for Stanford staff to travel to the site during and following storm events. Automation devices are anticipated to improve the ability of the structure to maintain proper bypass flows for steelhead under changing stream flow conditions.

2. Operation of Los Trancos Creek Diversion

Fish migrating upstream must have streamflows that provide suitable water velocity and depths for successful upstream passage (Bjornn and Reiser 1991). In addition, it is important to preserve streamflows that provide adequate depths and velocities supporting suitable and preferred habitats for temporarily resting and more stationary fishes, as well as spawning and incubation. The artificial reduction of stream flows can adversely affect steelhead by limiting opportunities for instream migrations and by reducing the quantity and quality of available habitat for steelhead.

To assess the effects of the operation of the Los Trancos Diversion on steelhead, this section of the biological opinion presents: (a) a description of Stanford's proposed bypass flow plan under the SHEP; (b) information and methods used to assess the relationship of instream flows to steelhead habitat conditions; and (c) the effects of proposed SHEP bypass flows on the freshwater life stages of steelhead.

a. SHEP Operations and Bypass Procedures for Los Trancos Diversion

When construction of SHEP facilities is completed, Stanford proposes to revise the operations plan and fish bypass flows at the Los Trancos Diversion facility. Under the SHEP, Stanford will operate the modified diversion dam with higher bypass flows during the season of diversion between December 1 and April 31. From December 1 through December 31, Stanford will not operate the Los Trancos Diversion when flows in Los Trancos Creek are less than 2 cfs, and all stream flow will remain in the channel to pass downstream of the diversion dam. However, if a storm event on Los Trancos Creek occurs during December or has occurred since October 1 of that year, which creates a daily average flow event in Los Trancos Creek of 8 cfs or greater (*i.e.*, "trigger"), Stanford will not operate the Los Trancos Creek Diversion when the creek flow is less than 5 cfs. After the "trigger' event, Stanford will allow 5 cfs to pass downstream prior to diverting water at the Los Trancos Diversion. Between January 1 and April 31, Stanford will provide a 5 cfs bypass at all times and the Los Trancos Diversion will only operate when flows in

Los Trancos Creek exceed 5 cfs. If and when flows in Los Trancos Creek exceed 8 cfs for a period of two hours or more at any time during the season of diversion (December 1 and April 31), Stanford will operate the Los Trancos Diversion to bypass 8 cfs of flow downstream of the facility. When flows drop to rates below 8 cfs, the Los Trancos Diversion will be operated to bypass 5 cfs (January through April) or to 2/5 cfs (December in conformance with the "trigger").

b. Method of Assessment of SHEP Operations at Los Trancos Diversion

Bypass flow needs to protect fisheries below the Los Trancos Diversion were assessed by NMFS using Los Trancos Creek information reported by Smith (1995) and Carmen and White (2004; 2005), as well as relevant scientific literature concerning the ecology of anadromous salmonids. In an assessment of stream flow requirements for migrating steelhead in Los Trancos Creek, Smith (1995) reported the depths across a series of five shallow riffles during at least three separate flow conditions. Carmen and White (2004) provided physical habitat data at five representative riffles and five pools in the reach of Los Trancos Creek downstream from the Los Trancos Diversion facility during flows ranging from 0.5 to 15 cfs. In 2005, Carmen and White (2005) systematically video-recorded riffles and pools in Los Trancos Creek over a range of flow conditions.

Additional information regarding the relationship of streamflow to suitable habitat and fish passage is available through published literature. Changes in streamflow will effect habitat suitability for steelhead upstream and downstream migration, spawning, egg incubation, rearing, and holding. For the upstream migration of adult steelhead, Thompson (1972) recommends a minimum passage depth criterion of 0.6 feet and he developed a method to determine passage flows for adult salmonids. Thompson's method entails identifying a series of shallow riffles that potentially affect fish passage, establishing transects across the shallowest locations, and then determining, for each transect, the flow at which a minimum depth criterion is maintained across both at least 25 percent of the total channel width and a contiguous minimum width of 10 percent of the channel. This method and modifications of this method have been widely used to establish appropriate instream flow regimes for adult salmonid passage.

Less information is available regarding the water depth requirements of downstream migrating juveniles and smolts, but 0.15 feet reported by Smith (1995) is likely the minimum necessary for downstream movements. Seaward smolt migrations of steelhead and salmon often coincide with increases in water discharge (White and Huntsman 1938; Allen 1944; Osterdahl 1969; Raymond 1979; Northcote 1984). Relatively large freshets also appear to cause large downstream movements of juvenile coho salmon (Chapman 1965). It is well documented that stream flow affects the travel rates of migrating smolts. Berggren and Filardo (1993), who examined the time that it takes juvenile steelhead to migrate through reaches in the Snake and Columbia rivers, reported that estimates of smolt travel time for yearling steelhead were inversely related to average river flows. Moreover, delays in the rate of downstream movement can influence smolt survival. Cada *et al.* (1994) concluded that relevant studies "*generally supported the premise that increased flow led to increased smolt survival.*"

Steelhead spawning and egg incubation conditions are significantly influenced by streamflows. The amount of spawning area available in a stream is regulated by the area covered by water and the velocities and depths of water over the gravel beds (Bjornn and Reiser 1991). Preferred water depths and velocities for steelhead have been determined from measurements at redds. Bjornn and Reiser (1991) report that steelhead typically spawn in water depths of approximately 0.8 feet and water velocities ranging from 1.3 to 3.0 feet per second. Higher flows typically provide greater riffle and pool depths, increased riffle velocities and pool volumes, and greater riffle widths than lower flows. Greater riffle and pool depths are expected to improve conditions for steelhead spawning and egg incubation. More inundated gravel surface areas will be available under higher flow conditions and higher water velocities typically enhance conditions within a redd for incubating eggs through replenishment of dissolved oxygen and removal of metabolic wastes (Bjornn and Reiser 1991)

For holding by both adult and juvenile steelhead, streamflow rates affect the amount of cover and susceptibility to predation. Water depth and surface turbulence provide important cover for fishes located in pools (Raleigh 1982; Raleigh *et al.* 1984). The value of elevated surface turbulence as cover for stream-dwelling salmon and steelhead has been recognized by many researchers (Jenkins 1969; Griffith 1972; Everest and Chapman 1972; Gibson 1978; Bjornn and Reiser 1991). Johnson *et al.* (1998) developed a classification system for rating the habitat value of various levels of surface turbulence, and the Federal Highway Administration (FHWA) acknowledges the role of surface turbulence as cover for fishes within pools (FHWA 2004). In Los Trancos Creek, most of the pools are relatively shallow (< 3 feet deep), and surface turbulence provides important cover from potential predators, including human poachers (NMFS 2006).

c. Effects of SHEP Operations at Los Trancos Diversion

Based on the results of work by Carmen and White (2004; 2005), Smith (1995), NMFS (2006), and published literature on the habitat requirements of steelhead, Stanford's proposed bypass flow criteria for the Los Trancos Diversion was assessed. The following assessment is presented chronologically through Stanford's season of diversion on Los Trancos Creek (December 1 through April 30).

Beginning December 1, the Los Trancos Diversion will bypass either 2 cfs (no "trigger" event) or 5 cfs ("trigger" event has occurred). This December minimum bypass flow is designed to provide a higher bypass flow (*i.e.,* 5 cfs) if there has been sufficient rainfall and an associated Los Trancos Creek flow event that allows adult steelhead to move upstream from San Francisco Bay through San Francisquito Creek into Los Trancos Creek. If no such storm event has occurred, it is unlikely that adult steelhead have entered Los Trancos Creek, and Stanford may operate the Los Trancos Diversion in a manner that maintains a base flow level consistent with typically natural flow conditions during the late fall months. This minimum bypass flow criteria of 2 cfs is expected to provide adequate conditions under dry conditions during December for juvenile steelhead residing in Los Trancos Creek, because the channel will remain wetted to the confluence with San Francisquito Creek and provide adequate water depths for residing juvenile fish. Smith (1995) concluded that 1 cfs flow in Los Trancos Creek is sufficient to sustain juvenile steelhead and provide for marginal downstream movements by smolts. The SHEP's proposed 2 cfs bypass for the month of December provides for twice the rate judged as sustaining by Smith (1995).

From January 1 through the end of the diversion season on April 30, the minimum bypass flow will be 5 cfs and no diversion of water may occur from the Los Trancos Diversion facility until streamflows exceed 5 cfs. By maintaining the frequency and duration of unimpaired flows of 5 cfs and less, the operation of the Los Trancos Diversion is expected to protect low flow periods and provide suitable conditions for spawning, incubation, rearing and smolt passage downstream of this water intake facility. Instream flow rates will not be reduced under these low flow conditions by the Stanford's Los Trancos Diversion, and both adult and juvenile steelhead will be unaffected during winter and spring base flows. Water depths and surface turbulence will be maintained to protect resting migrants and more stationary individuals.

When flows in Los Trancos Creek exceed 8 cfs, available information indicates water depths at riffles downstream of the Los Trancos Diversion will allow for the upstream passage of adult steelhead. Therefore, the Los Trancos Diversion operations plan provides for an increase in the minimum bypass flow to 8 cfs, when streamflows in Los Trancos Creek equal or exceed 8 cfs. This increase in the minimum bypass flow during periods of higher water is expected to facilitate the upstream passage of adult steelhead. The 8 cfs minimum bypass flow will remain continuous until flows in Los Trancos Creek naturally diminish to a rate less than 8 cfs. At which time, the 5 cfs minimum bypass flow criteria becomes effective. The 8 cfs bypass flow for the upstream migration of adult steelhead is supported by stream specific depth and velocity measurements at riffles in Los Trancos Creek downstream of the diversion facility. Smith (1995) and Carmen and White (2004 and 2005) both conclude a bypass flow of 8 cfs should adequately protect opportunities for upstream migration by adult steelhead, although Smith (1995) does caution regarding barriers formed by mobilized gravels needs to be considered in any bypass flow recommendation for Los Trancos Creek.

Overall, this two-stage (5 cfs and 8 cfs) minimum bypass flow criteria is anticipated to minimize the impacts of Stanford's water diversions upon steelhead in Los Trancos Creek. This protection of low flows in Los Trancos Creek is also expected to benefit streamflow in San Francisquito Creek below the confluence with Los Trancos Creek. Under dry conditions, higher bypass flows released to the channel below the Los Trancos Diversion will comingle with low flows in San Francisquito Creek and benefit steelhead spawning, incubation, rearing, and migration in San Francisquito Creek.

3. Maximum Rate of Diversion and Channel Morphology

Salmonid habitat quality is influenced by high stream flow events that move water sediment, and wood through stream channels (Montgomery 2004). Steelhead and salmon rely on streams to provide clean gravels, instream cover, sheltered pools, and channel/habitat diversity. In general, these important habitat attributes are maintained by fluvial processes including high stream flow events. A high rate of water withdrawal can cause a reduction in peak flows. Peak flow events (sometimes called "flushing flows") clean accumulated sediment and algae, maintain an active channel bed, and support a healthy, vibrant riparian vegetation community.

Rosgen and Silvey (1996) describe bankfull flows as those discharge events which channel maintenance occurs. Channel maintenance (*e.g.*, removing fine sediment, forming and reforming bars, and meandering) includes flow events that sustain natural geomorphic processes. Bankfull flows in Los Trancos Creek likely provide the necessary discharge rate for periodic channel maintenance functions. Storm events commonly create peak flows in Los Trancos Creek in excess of 100 cfs (Carmen and White 2005). Stream gage records for Los Trancos and San Francisquito creeks indicate bankfull flow events or greater occur in the creek every 1-2 years. Based on hydrological records and channel configuration, the high flow events that sustain geomorphic processes in Los Trancos Creek are not likely be significantly diminished by the operation of the Los Trancos Diversion. Therefore, it is expected that the magnitude and frequency of high flow events will continue to be sufficient for channel forming processes in Los Trancos Creek.

4. Maintenance Activities at the Los Trancos Fish Ladder and Diversion

The Los Trancos Fish Ladder and Diversion will require periodic maintenance. Maintenance efforts will include periodic gravel and debris removal from the ladder, inspections, maintenance, and repairs of gates and brush mechanisms and screens, and repairs of concrete structures. Clearing of accumulated gravel, sediments and debris may result in the discharge of small amounts of sediment into the flowing waters of the creek and an increase in turbidity downstream. These minor and localized elevated levels of turbidity will quickly disperse with stream flow downstream. Therefore, turbidity associated with sediment or debris removal is not expected to impair or harm steelhead and will not result in short-term or long-term impacts to aquatic habitat. Concrete repairs will be made in a manner ensuring the creek and fish are not exposed to uncured concrete. Thus, no impacts to fish or water quality are anticipated with concrete repairs.

If any juvenile steelhead are present in an area about to be disturbed by a maintenance activity, Stanford proposes to have a qualified fisheries biologist collect the individual fish with a small seine or dip net and relocate them to a suitable site in Los Trancos Creek downstream from the facility. The need for fish relocation of this type is expected to be rare since most maintenance activities will not occur in the live stream. Maintenance effects, other than fish relocation, are expected to minor, short term, and discountable.

C. San Francisquito Pump Station

Stanford's planned modifications for the San Francisquito Pump Station were developed in coordination with proposed changes at the Los Trancos Diversion. Prior to collaborative discussions between NMFS, CDFG, and Stanford, the SHEP only included project modifications at the Los Trancos Creek Diversion. The proposed modifications at the Los Trancos Diversion would greatly enhance the efficiency of the facility to annually divert water at a rate of up to 40 cfs between December 1 and April 30. As the need for higher bypass flows on Los Trancos Creek were identified by CDFG and NMFS, the SHEP incorporated modifications at the San Francisquito Pump Station to recapture some of the increased bypass flow originating from Los Trancos Creek.

1. Operation of the New San Francisquito Pump Station Fish Screen.

The new fish screen will prevent the entrainment and impingement of juvenile steelhead into Stanford's water system pipelines. The screen is designed to provide an approach velocity of 0.33 cfs or less which will allow the smallest life stages of steelhead to freely swim away from the face of the screen (*i.e.*, avoid impingement). The screen will also have a mesh opening of 3/32 inch or less which will prevent steelhead from being entrained into the intake. The fish screens are expected to provide adequate sweeping flows for fish to continue to move past the facility in San Francisquito Creek.

2. Operation of the Expanded San Francisquito Pump Station

As discussed above for Los Trancos Creek, it is important to preserve streamflows that provide adequate depths and velocities for upstream passage of adult steelhead and provide suitable habitat conditions for holding, spawning, incubation, and rearing. The reduction of stream flows due to water diversions can adversely affect steelhead by limiting opportunities for instream migrations and by reducing the quantity and quality of available habitat for steelhead.

To assess the effects of the operation of the San Francisquito Pump Station on steelhead, this section presents: (a) a description of Stanford's proposed bypass flow plan under the SHEP; (b) information and methods used to assess the relationship of instream flows to steelhead habitat conditions; and (c) the effects of proposed SHEP bypass flows on steelhead in San Francisquito Creek.

a. SHEP Operations and Bypass Procedures for the San Francisquito Pump Station

Upon completion of construction of the new fish screen, new surface intake, and expanded pump facilities, Stanford proposes to operate the modified San Francisquito Pump Station to always maintain a minimum bypass flow of 5 cfs (Table 1). As streamflows in San Francisquito Creek increase above 5 cfs, diversion rates may ramp up with increasing streamflow to a diversion rate of 6 cfs, but all diversion will cease when the creek is flowing between 12 and 16 cfs. When San Francisquito Creek is flowing at 17 cfs and higher, diversion rates may ramp up to the full 8 cfs diversion capacity, but diversion must again cease when the creek is flowing between 34 and 40 cfs. When San Francisquito Creek is flowing at 41 cfs and higher, diversion rates may again ramp up with streamflow to the full 8 cfs diversion capacity. The operational restriction from 34-40 cfs is designed to provide for the upstream passage of adult steelhead at the Bonde Weir. When structural improvements for fish passage at the Bonde Weir are completed, the operational restriction between 34 and 40 cfs will no longer apply.

b. Method of Assessment of SHEP Operations at San Francisquito Pump Station

As discussed above for Los Trancos Creek, fish migrating upstream must have streamflows that provide suitable water velocity and depths for successful upstream passage (Bjornn and Reiser 1991). On San Francisquito Creek, the focus of the NMFS' assessment below was on adult upstream passage and juvenile downstream passage, because the habitat conditions below the San Francisquito Pump Station are marginally suitable for steelhead spawning and juvenile rearing. San Francisquito Creek is primarily within an urban setting. Fine sediment, limited riparian vegetation, low habitat diversity, limited instream cover, and warm summer water temperatures render less than adequate conditions for steelhead spawning and rearing. However, rearing and spawning may occur in lower San Francisquito Creek and these conditions are included in the assessment below.

Bypass flow needs to protect fisheries below the San Francisquito Pump Station were assessed by NMFS using site-specific information collected by Stanford's consultant, Bill Carmen and NMFS biologist, Dr. Bill Hearn, and applying a modification of Thompson's (1972) method to determine passage flows for adult salmonids (NMFS 2006). Field data was collected at five riffle habitats in San Francisquito Creek during May 2005, using representative cross-sections. Depths across the study transects on San Francisquito Creek were determined by surveying each transect's bed profile, measuring the water surface elevation at three separate flows, and measuring depth and velocity across each transect at the middle flow. The hydraulic component of RHABSIM (Tom R. Paine & Associates' Riverine Habitat Simulation model) was used to interpolate and extrapolate depths and wetted width data at additional flows (NMFS 2006).

As presented above for Los Trancos Creek, additional information regarding the relationship of streamflow to suitable habitat and fish passage is available through published literature (Chapman 1965, Thompson 1972, Raymond 1979, Northcote 1984, Bjornn and Reiser 1991, Berggren and Filardo 1993, Cada *et al.* 1994). Using the site specific data from San Francisquito Creek and information from the published literature, streamflow rates were examined for potential effects to steelhead upstream and downstream migration, spawning, egg incubation, rearing, and holding in San Francisquito Creek downstream of the Pump Station.

c. Effects of SHEP Operations and Bypass Procedures at San Francisquito Pump Station

The operation of the San Francisquito Pump Station is anticipated to effect the migration of both adult and juvenile steelhead, as well as, holding, resting, and juvenile rearing. Steelhead spawning has not been recorded downstream of the San Francisquito Pump Station and habitat conditions suggest this area has limited value for spawning and egg incubation due to poor substrate quality.

Based on the results of work by Smith (1995) and NMFS (2006), the upstream migration of adult steelhead in San Francisquito Creek is constrained by more than one flow condition. Data collected at several riffles indicated that passage becomes difficult for adults moving upstream at most natural riffles when flow drops below 16 cfs. However, a formidable barrier to steelhead movement currently exists at a single location, known as the Bonde Weir. The Bonde Weir presents steep and shallow flow conditions in San Francisquito Creek across large concrete sill. Smith and Hardin (2001) report upstream passage is very difficult, but possible at 30 cfs. NMFS (2006) estimate passage is possible for highly motivated fish at flows ranging from 30 to 50 cfs. The Bonde Weir has been the subject of investigations and plans to modify the structure for fish passage are under development. Preliminary design plans propose to modify the Bonde Weir in a manner that will allow for upstream passage during San Francisquito Creek flows as low as 5 cfs (Howard 2007).

To address fish passage at both the natural riffle barriers and the currently unmodified Bonde Weir, a two-stage minimum bypass flow criteria has been proposed by the SHEP for the San Francisquito Pump Station. During periods of creek flow rates less than 12 cfs, shallow water depths at natural riffles make it difficult for adult steelhead to pass upstream. Pursuant to the SHEP's Operations and Bypass Procedure, when San Francisquito Creek flows are between 12 and 16 cfs, all pumping will cease and these flows become fully available for the upstream passage of steelhead adults and the downstream migration of smolts. When streamflows exceed 16 cfs, water diversions at the San Francisquito Pump Station may ramp up with increasing streamflows to full 8 cfs capacity and remain at full capacity until the creek is flowing at 34 cfs. At 34 cfs, diversions will again cease until streamflow exceeds 41 cfs. These two windows of no pumping, 12-16 cfs and 34-41 cfs, protect instream flow in San Francisquito Creek for upstream passage of adult steelhead and the seaward movement of smolts. However, when the Bonde Weir is modified to improve fish passage under low flow conditions, the upper window (*i.e.,* 34-40 cfs) of no pumping is no longer required, and Stanford's Operations and Bypass Plan allows elimination of this constraint. These operational measures are expected to minimize the downstream effects of water diversions at the San Francisquito Pump Station on migrating steelhead.

A third, low level, stage for minimum bypass flows has been proposed for the San Francisquito Pump Station to protect holding fish, spawning adults and rearing juveniles. The 5 cfs minimum bypass flow is expected to adequately protect stationary fish, such as adults resting in pools, spawning, and non-migrating juveniles. Available information indicates 5 cfs will maintain substantial depth in the stream's pools during the winter and spring (NMFS 2006). Data from the United State Geological Survey (USGS) gage on San Francisquito Creek indicates flows of 5 cfs or greater are exceeded only 56 percent of the time over the long-term between December 1 and April 30th. This means that flows in San Francisquito Creek are less than 5 cfs 44 percent of the time and, during this period, no water diversions will occur at the Pump Station. As discussed above for Los Trancos Creek, the minimum flow of 5 cfs is expected to improve conditions for juvenile steelhead through surface turbulence in pools and riffles, as well as, greater riffle and pool depths. Since Smith (1995) and NMFS (2006) report flows in excess of 12 cfs are required to provide adequate water depths over most riffles for adult upstream passage, the 5 cfs minimum flow will not facilitate the upstream migration of steelhead.

In summary, the variable increasing rate of diversion immediately following the three periods of no pumping is designed to ensure that 5 cfs, 16 cfs, and 34 cfs minimum is maintained in San Francisquito Creek when these natural flow conditions exist. The proposed operations plan for the San Francisquito Pump Station is expected to provide adequate conditions for holding fish and the maximum diversion rates of 8 cfs will be avoided when flows are in the vicinity of the critical passage thresholds of 12-16 cfs and 34-40 cfs.

3. Maximum Rate of Diversion and Channel Morphology

As discussed above for Los Trancos Creek, habitat quality for steelhead in San Francisquito is influenced by high stream flow events that move water, sediment, and wood through stream channels. Although urban conditions adjacent to the banks of San Francisquito Creek have degraded instream habitat conditions, the stream within the action area does provide some areas with clean gravels, instream cover, sheltered pools, and channel/habitat diversity. These important habitat attributes are maintained by fluvial processes including high stream flow ("flushing") events.

Based on hydrological records and channel configuration, the high flow events that sustain geomorphic processes in San Francisquito Creek will not likely be diminished by the expanded diversion capacity of the San Francisquito Pump Station. Storm events commonly produce peak flows in San Francisquito Creek of several hundred cfs (Jones and Stokes 2006). Therefore, it is expected that the magnitude and frequency of high flow events will continue to be sufficient for channel forming processes in San Francisquito Creek. The proposed withdrawal of up to 8 cfs is anticipated to have little to no effect on stream channel morphology downstream of the San Francisquito Pump Station.

4. Maintenance Activities at the San Francisquito Pump Station

The San Francisquito Pump Station will require periodic maintenance. Maintenance efforts will include periodic inspection, repair, and replacement of the pumps, screens, flow measurement devices, gravel, and debris removal from the vaults, and repair of concrete structures. Clearing of debris from the vaults will occur when the covers are above the water surface. Slots and boards inside the fish screens can be adjusted without creek water entering the vaults. Thus, no impacts to the creek are expected to occur during entry to the vaults and maintenance activities from the vaults.

Frequent cleaning of the screen will occur automatically with small jets of water in a backwash system. This cleaning system is anticipated to maintain screen openings and low water velocities through the screens.

If any juvenile steelhead are present in an area about to be disturbed by a maintenance activity, Stanford proposes to have a qualified fisheries biologist collect the individual fish with a small seine or dip net and relocate them to a suitable site in San Francisquito Creek downstream from the facility. This type of fish relocation is expected to be rare since most maintenance activities will not occur in the live stream. Overall, maintenance activities at the San Francisquito Pump Station are not expected to impact fish or degrade water quality.

D. Impacts to Designated Critical Habitat

The potential effects of the new SHEP facilities and their operation on designated critical habitat are primarily beneficial. The new fish screens on Los Trancos Creek and on San Francisquito Creek will prevent the entrainment and impingement of juvenile steelhead at both water intakes. The new fish ladder on Los Trancos Creek will significantly improve fish passage conditions, particularly by providing passage under low flow conditions. Construction of the fish screens, ladder and other facilities associated with the two water diversions is expected to result in short-term disturbance to the streambed in front of both existing facilities, but they will generally be localized and minor. Construction-related impacts to steelhead habitat have been presented above. The potential effects of Stanford's implementation of new operations plans for both facilities are also beneficial. Bypass flows will be provided below both water intake facilities. As discussed above, bypass flows are designed to provide for all freshwater life stages of CCC steelhead. In general, operation of Stanford's water diversion facilities will provide suitable conditions for fish passage, spawning, rearing, holding, and outmigration. Upon completion of the SHEP and implementation of the new Operations and Bypass Procedure, the project is expected to have negligible and discountable impacts on PCE's of designated critical habitat in both Los Trancos Creek and San Francisquito Creek.

E. Summary of Effects

Juvenile steelhead are expected to be present within the action areas on Los Trancos and San Francisquito creeks during construction. It is estimated that approximately 80 juvenile steelhead will be collected and relocated for dewatering and construction at the Los Trancos site, and approximately 100 fish will be collected and relocated at the San Francisquito Creek construction site. These fish likely make up a very small proportion of steelhead from the San Francisquito Creek watershed or the CCC steelhead DPS. Due to the timing of the proposed action, no adult steelhead or migrating steelhead smolts are expected to be adversely affected by the project construction. Impacts to individual steelhead will be minimized as the applicant proposes to relocate any steelhead present in the construction areas.

Based on the low mortality rates for relocation efforts and the small area of dewatering for construction, NMFS anticipates no more than two percent[4] of the juvenile steelhead present at the construction site will be harmed or killed by fish relocation activities. Experienced fish biologists are expected to have low injury and mortality rates during fish collections. Fish that elude capture and remain in the project areas during construction activities will likely be lost to thermal stress or crushed by heavy equipment. Steelhead are well distributed throughout the San Francisquito watershed. Due to the relatively large number of juveniles produced by each spawning pair, steelhead spawning in this watershed in future years are likely to produce enough juveniles to replace the few that may be lost at the project site due to relocation and dewatering. It is unlikely that the small potential loss of juveniles by these projects will impact future adult returns.

Upon completion, the new fish screens and new fish ladder are expected to benefit CCC steelhead. Potential entrainment and impingement of steelhead fry and juveniles is unlikely to occur due to the installation of fish screens that conform to NMFS and CDFG standards. Adult and juvenile steelhead will have full access to pass upstream at the Los Trancos Diversion structure under a wide range of flow conditions through the new fishway. Upon completion of construction, the SHEP will provide suitable fish bypass flows below the intakes in both Los Trancos and San Francisquito creeks with the implementation of the proposed new operational procedures.

On Los Trancos Creek, Stanford's diversion will be operated to achieve bypass flow rates of 5 cfs and 8 cfs. On San Francisquito Creek, Stanford's operations plan will provide minimum bypass flows of 5 cfs, 12 cfs, or 34 cfs which are based upon steelhead life history needs and instream flow and habitat conditions. The new bypass flows are expected to provide suitable conditions for adult upstream migration, spawning, egg incubation, juvenile rearing, and smolt outmigration. While the project will divert some flows from these creeks, these diversions are anticipated to have negligible and discountable impacts on PCEs of designated critical habitat on Los Trancos and San Francisquito creeks for CCC steelhead in the action area.

Habitat impacts, including effects to designated critical habitat, due to project construction are expected to be mostly temporary and minor disturbances to the streambed and flow of the streams. Project construction is not expected to impact riparian vegetation or the stream bank.

In summary, the proposed project is expected to result in minor and short term adverse effects to CCC steelhead and designated critical habitat during construction activities. The anticipated long-term effects of the project are beneficial to CCC steelhead and designated critical habitat by largely eliminating the impacts of Stanford's water diversions on stream flows important to

[4] Anticipated mortality from electrofishing and dewatering combined may exceed 1 percent of the fish in the area dewatered.

ensuring listed salmonids can complete their life history cycle. The proposed action is not expected to appreciably reduce the likelihood of the survival and recovery of CCC steelhead.

VI. CUMULATIVE EFFECTS

NMFS is not aware of any future State or private activities that are reasonably certain to occur within the action areas.

VII. CONCLUSION

After reviewing the current status of CCC steelhead, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed construction of Stanford's SHEP, and operation of the Los Trancos Diversion and the San Francisquito Pump Station are not likely to jeopardize the continued existence of threatened CCC steelhead.

After reviewing the current status of critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed SHEP is not likely to result in the destruction or adverse modification of designated critical habitat for CCC steelhead.

VIII. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS as an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the Corps or Stanford for the exemption in section 7(o)(2) to apply. The Corps has continuing duty to regulate the activity covered by this incidental take statement. If the Corps: (1) fails to assume and implement the terms and conditions, or (2) fails to require its designees to adhere to the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps or Stanford must report the progress of the actions and its impact on the species to NMFS as specified in the incidental take statement (50 CFR §402.14(I)(3)).

A. Amount or Extent of Take

The number of threatened steelhead that may be incidentally taken during construction at the Los Trancos Diversion is expected to be approximately 80 juvenile fish and limited to the pre-smolt juvenile life history stage. At the San Francisquito Pump Station, approximately 100 juvenile steelhead may be incidental taken during fish collection and relocation activities. NMFS anticipates no more than two percent of the juvenile steelhead present in the project areas to be dewatered will be harmed or killed during relocation, dewatering, and construction activities.

The number of threatened steelhead that may be incidentally taken during the operation and maintenance of the Los Trancos Diversion and the San Francisquito Pump Station is expected to include the juvenile and smolt life stages of CCC steelhead. However, the best scientific and commercial data available are not sufficient to enable NMFS to estimate a specific amount of incidental take of CCC steelhead. The precise number of fish cannot be accurately quantified due to: (1) the number of adult steelhead that may be migrating and spawning in San Francisquito and Los Trancos creeks in each year is unknown; (2) the precise number of juvenile steelhead rearing below Stanford's intakes is unknown; and (3) the precise number of outmigrating smolts from the watershed is unknown. Therefore, the water quality and habitat conditions for various steelhead life stages that would result from implementation of Stanford's Operations and Bypass Procedures for each facility shall serve as an ecological surrogate for the anticipated amount of incidental take associated with the on-going operation of Stanford's Los Trancos Diversion and San Francisquito Pump Station. Stanford's Operations and Bypass Procedure for the Los Trancos Diversion facility consist of the following:

a) Stanford will not divert from Los Trancos Creek, under any basis of right, between May 1 and November 30.
b) Diversions at the Los Trancos Creek diversion facility will be limited to the period between December 1 and April 30, as follows:
    i) The maximum instantaneous diversion rate will be limited to 40 cfs, less the simultaneous rate of flow diverted at the San Francisquito Creek facility.
    ii) Beginning December 1, the instantaneous bypass will not be less than 2 cfs (or natural flow, if less than 2 cfs).
    iii) Beginning January 1, or earlier if the "trigger" event described in paragraph c (below) occurs prior to January 1, the instantaneous bypass flows will not be less than 5 cfs (or natural flow, if less than 5 cfs) when creek flow upstream of the facility is less than 8 cfs, and will be 8 cfs when creek flow upstream of the facility is equal to or greater than 8 cfs for two hours.
c) The "trigger" event for flows described in paragraph b.iii (above) occurs when the mean daily (*i.e.*, calendar day) creek flow above the Los Trancos Creek diversion facility is 8 cfs or more at any time after October 1.

Stanford's Operations and Bypass Procedure for the San Francisquito Pump Station consist of the following:

a) Stanford will not divert from the San Francisquito Pump Station, under any basis of right, from July 1 through November 30.
b) Consistent with paragraph c (below), the maximum instantaneous rate of diversion at the San Francisquito Creek pump station (whether to the Felt Lake/campus distribution system, to Lagunita, or to both systems simultaneously) will not exceed 8 cfs.
    i) The maximum instantaneous rate of diversion to Lagunita will not exceed 4 cfs.
    ii) From December 1 through April 30, Stanford may divert up to 8 cfs at the San Francisquito Pump Station, even if the instantaneous diversion amount is greater than the flows simultaneously bypassed at the Los Trancos Creek diversion facility, provided that the combined instantaneous diversions at the San Francisquito Pump Station and the Los Trancos Creek diversion facility do not exceed 40 cfs.

c) From December 1 through June 30, the instantaneous bypass flows and the maximum instantaneous rate of diversion at the San Francisquito Pump Station will be as described in Table 1.

Table 1: Diversion rates proposed at the San Francisquito Pump Station. Q_{SF} is the abbreviation for flow, in cubic feet per second (cfs), in San Francisquito Creek above the pumping plan.

Q_{SF} cfs	Diversion cfs
0 - 5	0
6	1
7	2
8	3
9	4
10	5
11	6
12-16	0
17	1
18	2
19	3
20	4
21	5
22	6
23	7
24-33	8
34-40	0[a]
41-46	4[a]
47+	8

[a] Max diversion rate could be increased to 8 cfs over this range of flow if the Bonde Weir is modified to successfully and efficiently pass adult steelhead at flows of 16 to 100 cfs. (Modification of the Bonde Weir is not included in the SHEP.)

NMFS anticipates operation of the project in conformance with the above Operations and Bypass Procedures will maintain instream flow conditions in a manner that adequately protects and conserves habitat downstream of Stanford's water diversions. If Stanford's operation of the Los Trancos Diversion or the San Francisquito Pump Station creates flow conditions which deviate from the Operations and Bypass Procedures, the anticipated level of incidental take caused by the proposed action will be exceeded.

B. Effect of the Take

In the accompanying biological opinion, NMFS has determined that the anticipated take is not likely to result in jeopardy to CCC steelhead.

C. Reasonable and Prudent Measures

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of CCC steelhead:

1. Undertake measures to ensure that harm and mortality to listed steelhead resulting from fish relocation and dewatering activities is low.

2. Undertake measures to minimize harm to listed steelhead during and resulting from construction of the project.

3. Monitor operation of the Los Trancos Diversion and the San Francisquito Pump Station to ensure streamflows below the water intakes conform with the Operations and Bypass Procedures.

4. Prepare and submit a report to document the effects of construction and relocation activities and performance.

5. Prepare and submit an annual report regarding Los Trancos Diversion and San Francisquito Pump Station operations and fish bypass flows.

D. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Corps and Stanford must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. The following terms and conditions implement reasonable and prudent measure 1:

   a. The applicant shall retain qualified biologists with expertise in the areas of anadromous salmonid biology, including handling, collecting, and relocating salmonids; salmonid/habitat relationships; and biological monitoring of salmonids. The applicant shall identify to NMFS the personnel designated to conduct the fish relocation activities described in this opinion prior to project commencement and confirm their experience through resumes or other evidence of their accomplishments. Electrofishing, if used, shall be performed by a qualified biologist and conducted according to the *NMFS Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act, June 2000*. See: http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf.

b. The biologists shall monitor the construction sites during placement and removal of cofferdams, channel diversions, and access ramps to ensure that any adverse effects to salmonids are minimized. The biologists shall be on site during all dewatering events to capture, handle, and safely relocate ESA-listed salmonids. The Corps or the biologist shall notify NMFS biologist Gary Stern at (707) 575-6060 or Gary.Stern@noaa.gov one week prior to capture activities in order to provide an opportunity for NMFS staff to observe the activities.

c. ESA-listed fish shall be handled with extreme care and kept in water to the maximum extent possible during rescue activities. All captured fish shall be kept in cool, shaded, aerated water protected from excessive noise, jostling, or overcrowding any time they are not in the stream, and fish shall not be removed from this water except when released. To avoid predation, the biologists shall have at least two containers and segregate young-of-year fish from larger age-classes and other potential aquatic predators. Captured salmonids will be relocated, as soon as possible, to a suitable instream location in which suitable habitat conditions are present to allow for adequate survival of transported fish and fish already present.

d. If any salmonids are found dead or injured, the biologist shall contact NMFS biologist Gary Stern by phone immediately at (707) 575-6060 or the NMFS Santa Rosa Area Office at 707-575-6050. The purpose of the contact is to review the activities resulting in take and to determine if additional protective measures are required. All salmonid mortalities shall be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location of collection, fork length, and be frozen as soon as possible. Frozen samples shall be retained by the biologist until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than the NMFS Santa Rosa Area Office without obtaining prior written approval from the NMFS Santa Rosa Area Office, Supervisor of the Protected Resources Division. Any such transfer will be subject to such conditions as NMFS deems appropriate.

2. The following terms and conditions implement reasonable and prudent measure 2:

a. The Corps shall allow any NMFS employee(s) or any other person(s) designated by NMFS, to accompany field personnel to visit the project sites during activities described in this opinion.

b. Once construction is completed, all project-introduced material (pipe, gravel, cofferdam, sandbags, *etc.*) must be removed, leaving the creeks as they were before construction. Excess materials will be disposed of at an appropriate disposal site.

c. Construction equipment used within the creek channels will be checked each day prior to work within the creek channel (top of bank to top of bank) and, if necessary, action will be taken to prevent fluid leaks. If leaks occur during work in the channel (top of bank to top of bank), the Corps, the permittee, or their contractor will contain the spill and remove the affected soils.

d. All pumps used to divert live stream flow, outside the dewatered work area, will be screened and maintained throughout the construction period to comply with NMFS' *Fish Screening Criteria for Anadromous Salmonids*. See: http://swr.nmfs.noaa.gov/hcd/fishscrn.pdf.

e. In areas where concrete is used, a dry work area must be maintained to prevent direct contact between curing concrete and the surface waters of adjacent streams at all times. Water that inadvertently contacts uncured concrete must not be discharged into surface waters. All concrete shall be poured in the dry and shall be allowed to cure a minimum of seven (7) days before contact with water.

3. The following term and condition implements reasonable and prudent measure 3:

a. Stanford shall develop and install a system for accurately measuring daily stream flows on Los Trancos Creek and San Francisquito Creek including the amount of bypass flow downstream of these water intakes. Gage design plans shall be submitted to NMFS for review and approval by September 15, 2008. The stream gaging systems shall be operational no later than October 15, 2009.

4. The following term and condition implements reasonable and prudent measure 4:

a. The Corps or permittee shall provide a written report to NMFS by January 15 of the year following construction of the project. The report shall be submitted to NMFS Santa Rosa Area Office, Attention: Supervisor of Protected Resources Division, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The reports shall contain, at a minimum, the following information:

i. **Construction related activities** -- The report shall include the dates construction began and was completed; a discussion of any unanticipated effects or unanticipated levels of effects on salmonids, a description of any and all measures taken to minimize those unanticipated effects and a statement as to whether or not the unanticipated effects had any affect on ESA-listed fish; the number of salmonids killed or injured during the project action; and photographs taken before, during, and after the activity from photo reference points.

ii. **Fish Relocation** -- The report shall include a description of the locations from which fish were removed and the release site including photographs; the date and time of the relocation effort; a description of the equipment and methods used to collect, hold, and transport salmonids; if an electrofisher was used for fish collection, a copy of the logbook must be included; the number of fish relocated by species; the number of fish injured or killed by species and a brief narrative of the circumstances surrounding ESA-listed fish injuries or mortalities; and a description of any problems which may have arisen during the relocation activities and a statement as to whether or not the activities had any unforeseen effects.

5. The following term and condition implements reasonable and prudent measure 5:

a. Stanford shall provide a written report to NMFS by August 15 of each year regarding Los Trancos Creek stream flow conditions at the Los Trancos Diversion facility and San Francisquito Creek stream flow conditions at the San Francisquito Pump Station. The report shall be submitted to NMFS Santa Rosa Area Office, Attention: Supervisor of Protected Resources Division, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The reports shall contain, at a minimum, the following information:

i. **Los Trancos Diversion Operations.** The report shall include the dates water diversion began and was completed; daily water diversion rates, and total annual diversion volume.

ii. **Los Trancos Fish Bypass Flows.** The report shall include the daily average stream flow of Los Trancos Creek immediately downstream of the water intake. The report shall be organized by water year and Stanford's diversion season (*i.e.,* December 1 through April 30) with daily average stream flow rates for each day of the diversion season.

iii. **San Francisquito Pump Station Operations.** The report shall include the dates water diversion began and was completed; daily pumping rates, and total annual pumping volume.

iv. **San Francisquito Pump Station Fish Bypass Flows.** The report shall include the daily average stream flow of San Francisquito Creek immediately downstream of the water intake. The report shall be organized by water year and Stanford's diversion season (*i.e.,* December 1 through June 30) with daily average stream flow rates for each day of the diversion season.

IX. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, or to develop information.

(1) The Corps should work collaboratively with Stanford, the San Francisquito Watershed Council and other property owners in the San Francisquito watershed, and NMFS to remedy fish passage impediments for steelhead in Los Trancos Creek and San Francisquito Creek.

(2) The Corps should work collaboratively with Stanford, the San Francisquito Watershed Council, NMFS and other interested parties in the San Francisquito watershed to restore fish passage at Searsville Dam on San Francisquito Creek.

X. REINITIATION NOTICE

This concludes formal consultation on the proposed construction of Stanford's modifications to the Los Trancos Diversion facility and the San Francisquito Pump Station on the Stanford University Campus, California. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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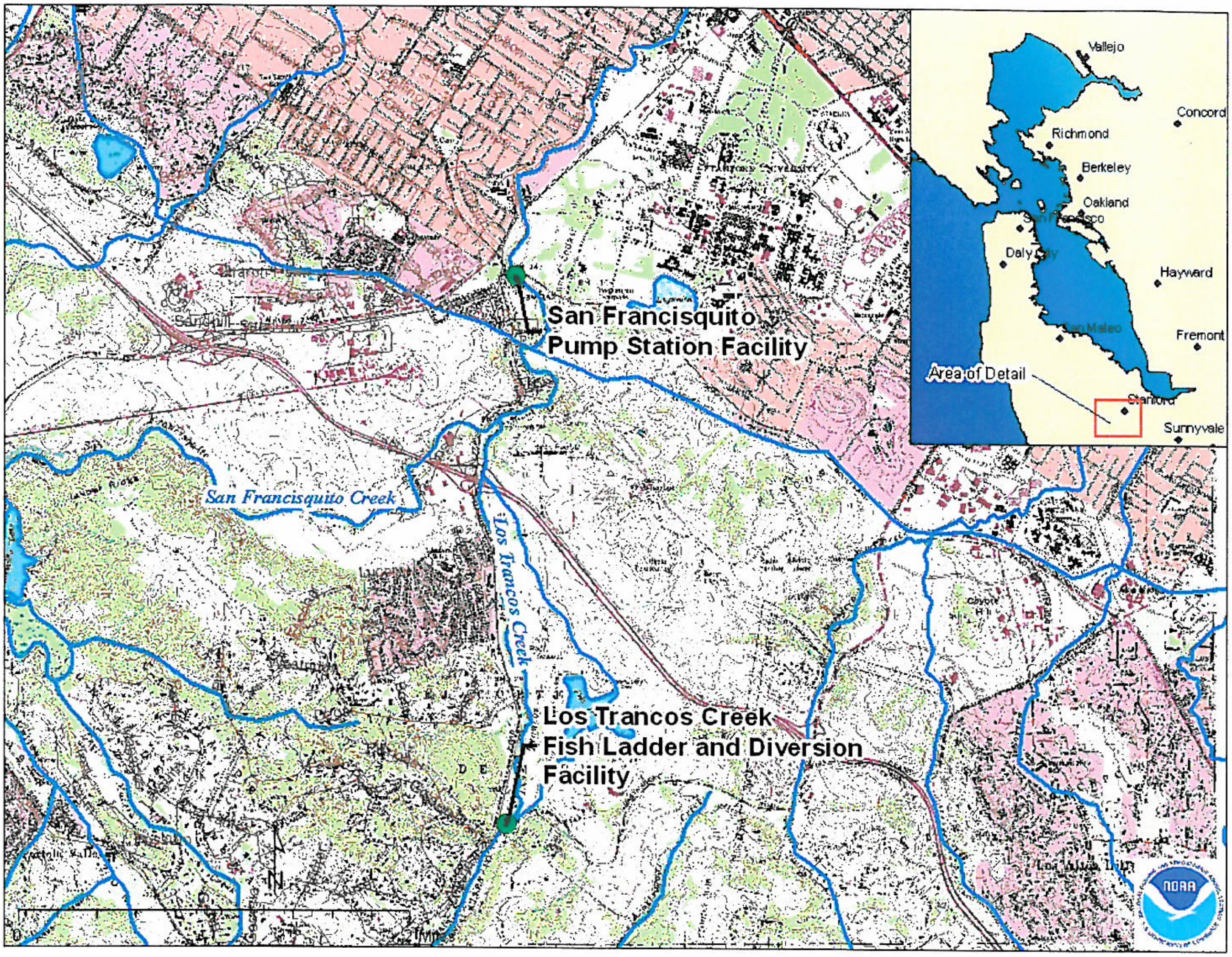

Figure 1. Map of the project area, including the locations of the Los Trancos Creek Fish Ladder and Diversion Facility and the San Francisquito Pump Station Facility.

STATE OF CALIFORNIA THE RESOURCES AGENCY — ARNOLD SCHWARZENEGGER, GOVERNOR

DEPARTMENT OF FISH AND GAME
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September 4, 2008

Notification Number: 1600-2005-0735-3

Tom Zigterman
Stanford University
327 Bonair Siding Road
Stanford, CA 94503

1602 LAKE AND STREAMBED ALTERATION AGREEMENT

This agreement is issued by the Department of Fish and Game pursuant to Division 2, Chapter 6 of the California Fish and Game Code:

WHEREAS, the Applicant Tom Zigterman, Stanford University, submitted a signed NOTIFICATION proposing to substantially divert or obstruct the natural flow of, or substantially change the bed, channel, or bank of, or use material from the streambed or lake of the following water: Los Trancos, San Francisquito, and Corte Madera creeks, located in various Sections of Township 6 south and Range 3 West, in the County of Santa Clara and San Mateo counties, State of California; and

WHEREAS, the Department has determined that such operations may substantially adversely affect existing fish and wildlife resources including water quality, hydrology, aquatic or terrestrial plant or animal species; and

WHEREAS, the project has undergone the appropriate review under the California Environmental Quality Act; and

WHEREAS, the Applicant shall undertake the project as proposed in the signed PROJECT DESCRIPTION and PROJECT CONDITIONS (attached). If the Applicant changes the project from that described in the PROJECT DESCRIPTION and does not include the PROJECT CONDITIONS, this agreement is no longer valid; and

WHEREAS, the agreement shall expire on December 31, 2027; with the work to occur between June 15 and October 15 unless extended; and

WHEREAS, nothing in this agreement authorizes the Applicant to trespass on any land or property, nor does it relieve the Applicant of the responsibility for compliance with applicable Federal, State, or local laws or ordinances. Placement, or removal, of any material below the level of ordinary high water may come under the jurisdiction of the U. S. Army Corps of Engineers pursuant to Section 404 of the Clean Water Act;

THEREFORE, the Applicant may proceed with the project as described in the PROJECT DESCRIPTION and PROJECT CONDITIONS. A copy of this agreement, with attached PROJECT DESCRIPTION and PROJECT CONDITIONS, shall be provided to contractors and subcontractors and shall be in their possession at the work site.

Failure to comply with all conditions of this agreement may result in legal action.

This agreement is approved by:

Scott Wilson FOR
Charles Armor
Regional Manager
Bay Delta Region

cc: Johnston, Atkinson, Leicester
Lieutenant Nores
Lieutenant Kelly

RECEIVED 9/4/08
-TWZ

State of California - The Resources Agency
ARNOLD SCHWARZENEGGER, Governor

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Notification Number: 1600-2005-0735-3
San Francisquito and Los Trancos Creeks and Felt Reservoir
Santa Clara and San Mateo Counties

Tom Zigterman
Stanford University
327 Bonair Siding Road
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PROJECT DESCRIPTION

General Project Description

This Agreement covers proposed activities and operations of Stanford University ("Stanford") as described below and in the project description submitted by Stanford January 5, 2007, attached hereto as Attachment 9 ("Stanford's Project Description"). The Department of Fish and Game ("Department") and Stanford agree that this Agreement applies to the project as set forth herein,[1] and that in the event that the project description below and Stanford's Project Description conflict, the project description below shall govern.

Stanford University is proposing to modify its existing water diversion and storage facilities at three locations: Felt Lake Reservoir, the diversion facility on Los Trancos Creek, and the diversion facility on San Francisquito Creek. The purpose of the proposed work is threefold: 1) to provide increased bypass flows in San Francisquito and Los Trancos Creeks; 2) to restore water storage capacity in Felt Lake Reservoir by removing 150,000 cubic yards of sediment; and 3) to increase the efficiency of Stanford's existing diversion facilities on Los Trancos and San Francisquito Creeks.

Stanford claims appropriative and riparian water rights to divert water from Los Trancos, San Francisquito and Corte Madera Creeks, as more fully described in Attachment 2, "Water Right Summary." Stanford uses water from these creeks primarily to irrigate the campus golf course, athletic fields, and campus landscaping, as well as for environmental, recreational, aesthetic and groundwater recharge purposes on campus.

[1] Stanford is not in agreement as to the biological need or justification for every measure set forth in this agreement; however, Stanford hereby agrees to implement and carry out all of the measures contained herein for purposes of carrying out the Project, with the understanding and on the condition that Stanford does not waive or concede any rights or positions with respect to the biological need and justification for the measures agreed to herein.

According to Stanford, it may also exercise its water rights to supply domestic and municipal water to the campus and surrounding communities in an emergency.

San Francisquito Creek is part of a local watershed that originates above Searsville Lake and drains a cumulative watershed of about 45 square miles. The creek is approximately 12 miles long and drains into San Francisco Bay. Los Trancos Creek is a major tributary to San Francisquito Creek, and merges with that creek just downstream of Interstate 280. Stanford's diversion facilities in relation to the local watersheds and area are shown in Attachment 3, "Lake Water Sources."

Los Trancos and San Francisquito Creeks both support populations of steelhead and California red-legged frog, both of which are listed under the Endangered Species Act as threatened, and other native aquatic species.

Felt Lake: Felt Lake is an artificial water storage reservoir fed by the water diversion from Los Trancos Creek and diffuse surface runoff from the surrounding area. The surrounding watershed is comprised mainly of grasslands, and the reservoir itself contains open water, fresh water emergent wetlands, adjacent seasonal wetlands, and nearby isolated seasonal wetlands. The surface area of the lake is just over 42 acres. The lake's capacity is currently approximately 937 acre feet ("af").

The Felt Lake project includes dredging Felt Lake Reservoir to its 1929 storage capability of 1,050 af to accommodate increased winter time water diversion. To dredge the reservoir, Stanford will need to drain it during the summer after its stored volume has been depleted to satisfy summer irrigation demand. The draining will be monitored by fisheries biologists who will respond in the event that any sensitive native species are encountered. After the lake is drained, approximately 150,000 cubic yards of silt and sediment will be excavated laterally below its high water level, using a clean scoop and lift approach. The excavated material will then be deposited in the upland borrow pits that were used originally to construct Felt Lake's dam, and in adjacent areas above the area covered by water at its high water (spillway) level.

Dredging activities will affect 21.20 acres of open water and 11.12 acres of fringe wetlands on the margins of the reservoir. All impacts associated with dredging will be temporary and will occur only after the reservoir has been drained. Stanford will mitigate for the loss of wetlands permanently destroyed by the placement of dredge fill in the borrow pits (.19 acres) nearby at a 2:1 replacement ratio. All other wetlands affected by the dredging are expected to naturally return within one to two seasons.

Future maintenance efforts at Felt Lake will include periodic sediment removal using clean scoop and lift methods, minor dam repairs, rodent control, and reshaping work at the flume entry and spillway areas. Those efforts will be conducted after the water levels have receded. Disturbed areas will be revegetated in accordance with the revegetation plan approved for the Felt Lake project.

Los Trancos Creek Diversion. The Los Trancos diversion dam and flume were originally constructed in the early 1870s. These facilities deliver water to campus lands through Felt Lake Reservoir. Stanford's appropriative water rights authorize Stanford to divert water from Los Trancos Creek up to the flume's 40 cubic feet per second ("cfs") capacity. Prior to 1995, flows in excess of diversion would spill over the diversion dam and its flashboards, or would be passed through the radial gate at the diversion structure.

In 1995, Stanford constructed a fish screen structure, a fish ladder, and a bypass channel at the diversion to allow fish passage at the diversion facility and to provide increased flows past the facility. The ladder was designed by the Department and the Department approved the fish screen and bypass channel. Since that time, flows to the diversion flume, ladder, and bypass have been controlled by the placement of flashboards in various configurations, depending on the creek's flow level. The fish ladder only operates effectively at a flow rate above 3 cfs, which has limited fish passage through the ladder to periods when flows are above 3 cfs.

The installation of the fish passage and diversion system components complicates and reduces the efficiency of Stanford's diversion operations. The configuration of the bypass channel, diversion flume, fish screen, and the ladder resulted in inefficient diversions during medium and high creek flows because streamflow does not back up properly against the screen and flume entrance. This has resulted in streamflow bypassing the facility rather than being diverted into the flume. Frequent clogging of the screen further reduces the ability to divert water into the flume. These design and operational problems have reduced Stanford's ability to divert during higher flow periods. In response, Stanford has attempted to maximize diversions during the low-flow periods from the December 1st through April 30th season of diversion. This is the system that is currently in place.

The new fishway structure is intended to accommodate fish passage over a much broader range of flows than the existing facility. In addition to increasing bypass flows in the lower flow season, the Los Trancos Creek project is designed to improve the efficiency and performance of the fish passage components by consolidating the bypass function with the fish ladder into one structure. To do so, Stanford intends to modify the design of the fish ladder and fish screen to allow it to more efficiently divert up to 40 cfs of water during high flow periods, while minimizing the water supply impacts that result from increased bypass during low-flow periods.

The Preliminary Los Trancos Creek Fish Ladder Facility Proposed Modification Site Plan sheet in Attachment 4-C is based on the preliminary design report by Wood Rodgers attached hereto as Attachment 6. The proposed modifications include:

- removing from service the existing fish screen cleaning system and fish ladder;
- grout-filling and abandoning in place the existing bypass channel;
- installing a new pool-and-weir fishway that will operate continuously, except during short maintenance periods in the summer);
- installing a new diversion control structure;
- modifying the fish screen; and

- installing a local control station.

The reconfiguration of the facility and added components, including the control structure, will back the water up higher against the screens, improving the efficiency of the diversion and reduce debris clogging of the screens. The existing dam, radial gate, flume, and access structure will remain in place. Flow measurement devices will be incorporated in the diversion facility to facilitate controls and operation. The physical and operational modifications to the Los Trancos Creek facility will rely on the use of modern electro-mechanical equipment and automated control mechanisms to regulate diversions and bypass flows according to a required diversion and bypass operating plan described in Attachment 1-A.

The new fishway structure has been designed to comply with current Department and National Marine Fisheries Service ("NMFS") criteria for anadromous fish passage, and will be installed into the existing berm between the creek and flume. The fish screen modifications and proposed screen clearing mechanism will also conform to current Department and NMFS criteria. The new diversion control structure, fishway slide gate, and automated control mechanisms will be installed and configured such that the diverted flow and bypass flow can be controlled as a function of total creek flow. Creek flow can physically be routed either through the new fishway, through the existing radial gate spillway structure, over the existing dam, or diverted through the modified fish screen structure and into the flume to Felt Lake. The minimum bypass flows in this Agreement will be measured as the flow below the facility, which shall be comprised of the flows passed through the fish ladder and flows or seepage through the radial gate. Stanford will ensure that the available flow is routed to and passed through the fish ladder (as opposed to the radial gate) to ensure passage and attraction flows through the fish ladder facility for steelhead of all life stages, consistent with the operational design of the fish ladder facility.

The three pages of the Wood Rodgers design for the Los Trancos facility (Attachments 4-A, 4-B, and 4-C) contain preliminary drawings for construction phasing/staging, creek diversion, and other provisions to avoid and minimize construction impacts. Fisheries biologists will be involved prior to and during any work to ensure that steelhead and other native species are not present in the work area, and will not be adversely affected during construction activities.

Stanford reported that diversions in the five-year period from 1999 to 2004 averaged 592 af per year at this facility. The proposed modifications to the facility will restore Stanford's ability to maximize diversion rates during periods of high flow (up to 40 cfs minus the amount to be picked up at San Francisquito Creek under Water Rights License 1723). Overall diversion amounts at the modified facility, had it been in place during the 1999 to 2004 period, would have been reduced to an average 490 af per year, to allow the additional bypass flows for instream resources immediately below the facility.

Construction for the Los Trancos Creek project will result in temporary impacts to 0.005 acre, and permanent impacts to 0.017 acre of jurisdictional waters/wetlands. The total length of affected channel is approximately 109 linear feet at the Los Trancos Diversion Structure. All temporary disturbance areas will be restored to equal to, or better than pre-project conditions. Disturbed banks will be planted with native riparian vegetation. Mitigation for permanent impacts includes the restoration and stabilization of a 0.013-acre failing bank in the project area. All riparian trees that are removed will be mitigated at a 3:1 ratio.

Typically, ladder access for sediment removal or repairs will be accomplished by the redirection of flow through the radial gate, and removal of the cover grates and opening of clean-out ports in the bottom of the baffles, or hand clearing of accumulated sediment and other materials. Following large storms, accumulated gravel in the flume/ladder entry area will be removed as necessary by following procedures developed in consultation with the Department and NMFS. Any necessary concrete repairs will be made in a manner ensuring that fish are not exposed to uncured concrete. Future maintenance efforts will include periodic gravel removal from the ladder, inspections and maintenance of the gates and brush mechanisms and screens, and repairs of the concrete structures.

The diversion and bypass operation for the modified Los Trancos Creek Diversion Facility is described in detail in Attachment 1-A.

San Francisquito Creek Diversion: The current San Francisquito Creek Pump Station is located in San Francisquito Creek, just over one mile below the confluence of Los Trancos and San Francisquito Creeks, and was constructed in 1998. This new pump station was constructed with two pairs of pumps: one pair for the Lagunita diversion, and a second pair ("Felt pumps") to divert water: 1) that was allowed to bypass the Los Trancos Creek facility as a result of installation of the Los Trancos Creek fish ladder in 1995; and 2) to exercise other water rights claimed by Stanford described in Attachment 2. The 1998 pump station replaced a pump station that had been previously used exclusively to divert water to Lake Lagunita. The four pumps divert water collected in an infiltration gallery intake. The infiltration gallery did not function properly until 2004, as a result of sediment deposits along the inside of the Creek bend, which is located atop the infiltration gallery.

The two Lake Lagunita pumps lift water from San Francisquito Creek to the Lake Lagunita flume near the top of bank, which extends across Junipero Serra Boulevard through the campus golf course and across Campus Drive West to Lake Lagunita. The Lake Lagunita pumps are physically and hydraulically not able to pump to Felt Lake.

The two Felt Lake pumps divert water from San Francisquito Creek to a pipeline that connects Felt Lake to the lake water distribution system. The Felt Lake pumps are not connected directly to the Lake Lagunita flume; however, water from Felt Lake and its pipeline to the lake water system can be conveyed to Lake Lagunita.

Each pair of pumps in the current station has a capacity of 4 cfs. The pumps operate one pair at a time, but not simultaneously, due to limitations of the intake system and the usually low creek flow rate in the spring when the Lake Lagunita diversions are generally needed. Currently, the maximum instantaneous rate of diversion for this facility does not exceed 4 cfs. Stanford typically operates the pumps from December 1st through June 30th.

As part of the San Francisquito Creek project, Stanford will modify the San Francisquito Creek Pump Station to facilitate capture of bypassed flows from the modified Los Trancos Creek diversion facility, and additional water under other claimed water rights. The capacity of the Felt Lake pumps will be increased from their current 4 cfs capacity to an instantaneous diversion capacity of 8 cfs. This 8 cfs diversion rate is the maximum rate that can be accommodated in the existing pipeline between the station and Felt Lake. The diversion capacity of the Lake Lagunita pumps and the intake capacity of the infiltration gallery will not change. Although Stanford will screen for a 12 cfs surface diversion, Stanford has agreed to limit the maximum total instantaneous diversion rate at this facility to 8 cfs for purposes of this Agreement. The bypass and diversion operation plan is described in Attachment 1-B.

A preliminary drawing showing the proposed modifications to this facility is in Attachment 5. The proposed modifications, which are subject to review and approval by the Department, include:

- the addition of a new Felt Lake pump/motor to increase Felt pumping capacity to a total of 8 cfs;

- the upsizing of the entire electrical service and system to serve the new larger pump/motor;

- the addition of a 12 cfs capacity surface intake system, properly screened, in order to provide additional and more reliable intake capacity to the pumps;

- the installation of rock spurs upstream of the pump station to guide and stabilize creek flow to the intake gallery and fish screens where it was prior to the construction of the current pump station:

- raising of the pump vault lids above the low flow water level for maintenance access; and

- the installation of stream flow measuring devices so diversions and bypass flows can be regulated with respect to flow.

The flow of San Francisquito Creek will be redirected around the work area to allow construction of the above-described improvements. All creek construction work will take place during low flow summer months when fish will be easier to detect and capture, if necessary. Work will be performed under the direction of qualified biologists to avoid adverse effects to fish and wildlife resources in the work area. As with the Los Trancos work, fisheries biologists will be involved prior to and during any work to ensure that steelhead and other native species are not present in the work area, and will not be adversely affected during construction activities. The work area will be isolated and dewatered using a coffer dam and bypass pipe, and fish or other species will be removed following the protocol developed in consultation with the Department and NMFS. Stanford shall submit and have approved by the Department and NMFS detailed design drawings and specifications.

The bypass flow and diversion operations plan for the proposed San Francisquito Creek project (see Attachment 1-B) is intended to improve the bypass flow regime in San Francisquito Creek to provide improved flow conditions for steelhead passage and habitat. As such, bypass flow terms were developed to improve migration by reducing diversions at identified key flow ranges. In these flow ranges, increased bypass flows will facilitate passage through downstream segments of the creek that have difficult passage conditions. If at a later date modifications at downstream barriers occur that would provide fish passage at those locations at reduced flows, Stanford may prepare a new bypass flow plan and submit it to the Department for review and approval as part of a request to amend this Agreement. For example, Stanford could propose changes to the protective bypass flow terms found in Attachment 1-B if there were a modification of both the Transect 3 and the Bonde Weir barriers that allowed successful and efficient passage of adult steelhead at Transect 3 at flows between 16 and 40 cfs and at the Bonde Weir at flows between 16 cfs and 100 cfs.

The San Francisquito Creek project will result in 0.012 acre of permanent fill and 0.046 acre of temporary impact within San Francisquito Creek. All temporarily disturbed bed and bank will be restored to better than pre-project conditions with native riparian plantings. Permanent impacts at San Francisquito Creek Pump Station will be mitigated through wetland creation and riparian restoration and enhancement along the San Francisquito Creek corridor, to the west of Interstate 280. All riparian trees that are removed will be mitigated at a 3:1 ratio. All work will conform to the mitigation plans prepared by Stanford and approved by the Department.

In addition to typical water demands, diversion is often needed for Lake Lagunita to sustain water levels for the benefit of California tiger salamanders ("CTS"), a federally-protected species and state Species of Special Concern. During the wet winter months, CTS migrate to Lake Lagunita and lay their eggs, which then rely on sustained water level in Lake Lagunita for survival. Because Lake Lagunita percolates its water quickly, water levels must be replenished, either by storm runoff or artificially from creek diversions. Stanford will operate the pump station through June 30th to supply water to Lake Lagunita as described in Attachment 1-B. If creek flows are inadequate to meet water demands at Lake Lagunita for CTS, Stanford will rely on water from other sources to meet this need.

For the San Francisquito Creek Pump Station Diversion Facility, maintenance efforts will include periodic inspection, repair and replacement of the pumps, screens, flow measurement devices, and concrete structures, gravel removal from the vaults, and possible adjustment of the bendway weirs. The raising of the pump vault covers above the low creek water level, as part of the project, will facilitate access to the pumps and vaults without creek entry. Also, slots and boards inside the screens will enable them to be accessed without creek water entering the vaults.

Searsville Dam and Reservoir: Stanford also diverts water at Searsville Dam, approximately 1,000 feet above the confluence of San Francisquito Creek and Bear Gulch Creek. Searsville Dam was constructed in 1890 and has been in operation since that time. Diversions at Searsville occur by gravity flow through a 16-inch diameter pipe with a screened opening just upstream of the dam. The pipeline extends through the dam, and continues to the campus distribution system as a 12-inch diameter pipeline. The diversion includes no infiltration gallery, flume, or pumps, and is operated by manual opening of a valve to the pipeline that is hydraulically limited to 3 cfs (as it has always been). There is no outlet valve or bypass facility at Searsville Dam. Searsville Lake has accumulated sediment over the last century, displacing approximately 90 percent of the original 1000 acre-feet storage volume.

Diversions at Searsville occur after the initial rainy season storms when the reservoir is spilling, and continue into the late spring/early summer after the dam stops spilling. For most of the rainy season, the dam spills continuously, except occasionally during long periods without storms. The spillway is a 60-feet long, four feet high section along the top of the dam. The rate of spill varies widely with precipitation events, and can be as high as several thousand cfs.

Stanford's diversions at Searsville are minimal in relation to overall streamflow and discharge from within the watershed (i.e., less than a few hundred acre-feet per year versus the thousands of acre-feet of total spill flow at Searsville alone). Stanford's diversions at Searsville are the most senior diversions in the watershed. The stream reach below Searsville, above the confluence with Bear Gulch Creek, is low quality as steelhead habitat, as compared to other stream reaches in the watershed (including Bear Gulch Creek).

The description of Searsville Dam and Reservoir is included here for informational purposes only. Operations at the Searsville Dam and Reservoir were not part of Stanford's notification to the Department and the Department has not made a determination as to the applicability of Fish and Game Code section 1600 *et seq.* to Searsville Dam and Reservoir.

ATTACHMENTS

Attachment 1-A: Diversion and Bypass Operations at Los Trancos Creek

Attachment 1-B: Diversion and Bypass Operations at San Francisquito Creek

Attachment 2: Water Rights Summary

Attachment 3: Lake Water Sources

Attachment 4-A: Preliminary Los Trancos Creek Fish Ladder Facility Flow Through Proposed Structure Site Plan prepared by Wood Rodgers, dated April 13, 2005. (The preliminary operating strategy on the sheet has been superseded and is no longer valid.)

Attachment 4-B: Preliminary Los Trancos Creek Fish Ladder Facility Existing Structures Site Plan prepared by Wood Rodgers, dated January 12, 2006.

Attachment 4-C: Preliminary Los Trancos Creek Fish Ladder Facility Proposed Modification Site Plan, prepared by Wood Rodgers, dated April 13, 2004.

Attachment 5: The San Francisquito Creek Pump Station Capacity Upgrade Improvements, comprising one sheet drafted by Wood Rodgers, dated January 24, 2006.

Attachment 6: Wood Rodgers preliminary design report (April 13, 2004).

Attachment 7: Steelhead Monitoring Program in Los Trancos Creek, Biological Surveys for Steelhead Passage and Habitat Quality on Los Trancos Creek, 2003-2005 (Carmen, 2005).

Attachment 8: An Assessment of Bypass Flows to Protect Steelhead below Stanford University's Water Diversion Facilities on Los Trancos Creek and San Francisquito Creek (Stern, 2005)

Attachment 9: Stanford's Streambed Alteration Application (submitted in October, 2005) and revised Project Description (May 29, 2007).

PROJECT MEASURES

Project Description and Attachments

The measures set forth below and in Attachments 1-A and 1-B are enforceable requirements for the project as described in this Agreement and in Attachment 9. Attachments 2 through 9, inclusive, are part of the administrative record for this Agreement. Attachments 2 through 9 are provided for informational purposes only and are not incorporated herein as measures.

Commencement of Construction

Commencement of construction is defined in this Agreement to be any new diversion or obstruction of the natural flow of, or the disturbance of the bed, channel, or bank of a river, stream, or lake by construction equipment, materials, or activities associated with the construction, operations, or maintenance activities covered by this Agreement.

Measures for All Three Projects

1. The presence of heavy machinery used in the fish ladder and pump station construction and staging areas, and necessary dewatering activities at both Los Trancos and San Francisquito Creeks, and the need for access and staging areas at all sites could potentially adversely affect sensitive habitats and cause direct and indirect injury or death to steelhead, California red-legged frog, and other native species. Stanford will consult with the appropriate agencies to develop a Biological Impacts Minimization Plan to avoid and minimize the biological impacts of construction and maintenance to sensitive habitats and species. The plan shall be submitted to the Department for review and approval prior to commencing construction. The plan shall include at a minimum, the following:

a. the duties, responsibilities, and qualifications of the Project Biologist (also referred to as the Ecological Monitor) and qualified fisheries and wildlife biologists working on the Project;

b. appropriate measures for removal and relocation of steelhead, California red-legged frog, and other native species prior to Project construction and during maintenance;

c. acceptable protocols for assuring that steelhead, California red-legged frog, and other native species do not re-enter the Project sites;

d. the procedure for supervising the installation and maintenance of construction fencing to protect the riparian zone and other sensitive areas prior to and during construction activities;

e. procedures for prevention and containment of pollutants from heavy equipment and service vehicles operating near the stream zone;

f. appropriate measures for removal and/or relocation any steelhead, California red-legged frog, and other native species encountered on the Project site after initial removal and relocation efforts;

g. best management practices, such as hay bales, silt fencing, provision of gravel filters, to minimize sedimentation downstream of the construction site.

h. identification of the location and areas impacted, including the staging areas and assess points, to allow appropriate measures to be developed to minimize impacts to all sensitive areas impacted by the Project; and

i. identification of expected routine maintenance activities at all facilities covered by the Agreement, and how those activities will be carried-out (e.g., work periods, equipment used, proposed avoidance/minimization measures).

2. Prior to commencing construction, Stanford shall submit and have approved by the Department, a mitigation and monitoring plan for the restoration and mitigation measures intended to compensate for the loss, both temporary and permanent, of wetlands, instream habitat, and riparian vegetation. Such losses include those within the construction, staging, and access areas. The submittal should include a planting schedule, site plan, any necessary irrigation details, target and success criteria, and a monitoring schedule.

3. Prior to commencing construction, a qualified biologist shall conduct an educational session for the work crews and foremen. The session shall include identification concerning the sensitive habitat, sensitive resources present, the need for special care to avoid impacts, and appropriate procedures to follow if any sensitive species enter the work areas.

Felt Lake Project Measures

4. As part of the Biological Impacts Minimization Plan, and prior to commencing construction, Stanford shall submit a detailed monitoring, rescue, and restoration plan for aquatic resources at Felt Lake. The plan shall be approved by the Department before work begins. The plan shall:

   a. identify how any remaining water will be removed and where it will be taken or discharged;

   b. if water is to be drained, specify how aquatic life will be prevented from being stranded or entrained by the pumping or flow through a ditch;

   c. identify what will be done with both native and non-native wildlife stranded by the drawdown and include a narrative for each species or groups of species potentially found with similar requirements;

   d. provide details on what the desired species mix will be in the lake after restoration, including the information already provided in the response to the Department's previous incomplete determination letter to Stanford; and

   e. Include measures to ensure there is no release of exotic species or pathogens into nearby watercourses.

5. Prior to commencing construction, Stanford shall submit a detailed grading, drainage, and erosion control plan for the dredging of the spoils from Felt Lake, and the placement of the excavated material as fill in nearby locations. The plan shall be approved by the Department before work begins.

6. Any sediment removal after the initial grading described in the plan required in Condition 4 shall occur only after consultation with the Department to determine if the activity is jurisdictional (i.e., subject to Fish and Game Code section 1602). If the activity is jurisdictional, the Department will notify Stanford if the proposed activity requires an amendment to this Agreement or a new Streambed Alteration Agreement.

Los Trancos Project Measures

7. Prior to commencing construction, Stanford shall submit and have approved by the Department detailed design drawings and specifications for the Los Trancos project, including plans for the screen and fishway, measuring devices, and access and staging areas.

8. Prior to commencing construction, Stanford shall submit and have approved by the Department a detailed grading, drainage, and erosion control plan for the construction of the Los Trancos Diversion facility, and the bank stabilization project proposed as mitigation for instream habitat impacts downstream.

9. No more than 48 hours prior to commencing construction, a qualified biologist shall

survey the project area for the presence of steelhead, California red-legged frogs, western pond turtles, and other native species. If individuals of these species are located, the procedures in the approved Biological Impacts Minimization Plan shall be followed.

10. The Project Biologist shall monitor the site in accordance with the schedule in the Biological Impacts Minimization Plan to ensure the exclusion fencing is sound and in place, and that no sensitive species have entered the work area. If sensitive species have entered the work area, the procedures in the approved Biological Impacts Minimization Plan shall be followed.

11. To the extent practicable, work must be performed in isolation from the flowing stream. If there is any flow when the work is done, Stanford shall construct coffer dams upstream and downstream of the excavation site and divert all flow from upstream of the dam to downstream of the dam. The coffer dams shall be constructed with clean river gravel or sand bags, and may be sealed with sheet plastic. Sand bags and any sheet plastic shall be removed from the stream upon project completion. Clean river gravel may be left in the stream, but the coffer dams must be breached to return the stream flow to its natural channel. If Stanford wishes to use another method, it shall submit a proposal to the Department for its review and approval as part of the Biological Impacts Mitigation Plan.

12. Prior to commencing any construction at the Los Trancos facility, Stanford shall submit a screening plan for the Los Trancos diversion consistent with the Department's and NMFS's fish screening criteria as verified by those agencies' engineers. Work shall not begin until the Department has approved the design.

13. The minimum bypass flows in this Agreement will be measured as the flow below the facility, which shall be comprised of the flows passed through the fish ladder and flows or seepage through the radial gate. Stanford will ensure that the available flow is routed to and passed through the fish ladder (as opposed to the radial gate) to ensure passage and attraction flows through the fish ladder facility for steelhead of all life stages, consistent with the operational design of the fish ladder facility.

14. Diversion shall only occur at this facility between December 1st and April 30th. No flows shall be diverted and all flows shall bypass the Los Trancos facility from May 1st to November 30th each year.

15. Stanford agrees not to exceed the maximum instantaneous rates of diversions and to meet the minimum bypass flows in Attachment 1-A.

16. Prior to commencing any construction, Stanford shall submit and have approved by the Department a Flow Ramping Plan to avoid impacts to downstream resources due to abrupt changes in released or diverted flows.

17. Prior to commencing any construction, Stanford shall submit and have approved by the Department a Sediment Removal/Replenishment Plan for this facility.

San Francisquito Project Measures

18. Prior to commencing any construction, Stanford shall submit and have approved by the Department the detailed design drawings and specifications for the San Francisquito Creek project, including plans for the rock spurs, infiltration gallery, and intake gallery, fish screens, measuring devices, and staging and access areas.

19. Prior to commencing any construction, Stanford shall submit and have approved by the Department a detailed grading, drainage and erosion control plan for the construction of the San Francisquito Creek diversion facility.

20. No more than 48 hours prior to commencing any construction, a qualified biologist shall survey the project area for the presence of steelhead, California red-legged frogs, western pond turtles, or other native species. If individuals of these species are located, the procedures in the approved Biological Impacts Minimization Plan shall be followed.

21. The Project Biologist shall monitor the site on a scheduled as agreed to in the Biological Impacts Minimization Plan to ensure the exclusion fencing is sound and in place and that no sensitive species have entered the work area. If sensitive species have entered the work area, the procedures in the approved Biological Impacts Minimization Plan shall be followed.

22. To the extent practicable, work must be performed in isolation from the flowing stream. If there is any flow when the work is done, Stanford shall construct coffer dams upstream and downstream of the excavation site and divert all flow from upstream of the dam to downstream of the dam. The coffer dams shall be constructed with clean river gravel or sand bags, and may be sealed with sheet plastic. Sand bags and any sheet plastic shall be removed from the stream upon project completion. Clean river gravel may be left in the stream, but the coffer dams must be breached to return the stream flow to its natural channel.

23. The operator shall construct a sediment barrier parallel to the bank and just outside the project area. The sediment barrier shall be an impervious sheeting or very tight mesh filter fabric well-anchored to the bottom of the stream and reaching above water level sufficiently high to contain the roiled water along the bank. The sediment barrier shall be tied into the bank upstream and downstream of the work site to isolate the work site from the flowing stream. If Stanford wishes to use another method, it shall submit a proposal in the Biological Impacts Minimization Plan for review and approval.

24. Prior to commencing any construction at the San Francisquito facility, Stanford shall submit and have approved by the Department and NMFS a screening plan for the San Francisquito Diversion facility.

25. Stanford agrees not to exceed the maximum instantaneous rates of diversion and to meet the minimum bypass flows in Attachment 1-B. At no time shall the maximum instantaneous rate of diversion at this facility exceed 8 cfs.

26. Diversion shall only occur at this facility between from December 1st through June 30th. No flows shall be diverted and all flows must bypass the San Francisquito Creek facility from July 1st to November 30th each year.

27. Prior to commencing any construction, Stanford shall submit and have approved by the Department a Sediment Removal Plan for this facility.

Compliance Monitoring Measures

28. Flow measuring devices shall be installed for the purpose of taking real time measurement of the following:

    a. the instantaneous rate of flow (measured in cfs) in Los Trancos Creek at a point approximately 150 feet upstream (or as otherwise agreed to by the State Water Resources Control Board) and at the diversion facilities or downstream of the Los Trancos Creek Felt Lake Diversion Flume;

    b. the instantaneous rate (measured in cfs) and quantity (measured in af) of all water diverted into the Los Trancos Felt Lake Diversion flume;

    c. the instantaneous rate of flow (measured in cfs) in San Francisquito Creek at a point upstream and a point downstream of the San Francisquito Creek Diversion Facility; and

    d. the instantaneous rate (measured in cfs) and quantity (measured in af) of all water diverted at the San Francisquito Creek Diversion facility.

29. The records from the above flow measuring devices shall be used to carry out a flow compliance monitoring program, specifically designed to demonstrate full compliance with the measures of this Agreement.

30. Data collected under the flow compliance monitoring program shall consist of daily average flows and daily minimum and maximum instantaneous flows. More detailed data, for example, hourly flows, shall be made available to the Department on request.

31. By August 1st of each year, a summary of the report of the flow compliance monitoring program conducted over the previous diversion season shall be provided to the Department. The report shall provide a summary of the flow data collected in a manner that clearly demonstrates whether or not the flow and diversion rate measures of the Agreement were met.

Project Effectiveness Monitoring Plan

32. As part of the Department's review of the Agreement pursuant to the California Environmental Quality Act, Stanford shall submit to the Department a monitoring plan for its review and evaluation. The purpose of the monitoring plan will be to

evaluate and document that the modification and operation of the facilities are achieving the steelhead passage and habitat enhancing objectives of the modifications and proposed bypass flows. These objectives are the protection of steelhead from entering diversion flows (by screens) and adequate depth and flow for passage and sustaining pools. The plan shall include at a minimum the following elements:

a. a date on which the annual report will be submitted;

b. identification of monitoring points at critical passage areas, such as riffles or barriers, that will monitored to ensure that passage has been achieved;

c. identification of monitoring points at critical rearing areas that will monitored to ensure that flow enhancement is supporting rearing habitat;

d. the methods and criteria used to evaluate the critical areas to determine whether habitat value and/or passage ability has been improved and, if so, by how much; and

e. if the observed flows have not improved conditions, possible additional measures that could achieve the desired ends.

Status Report

33. Stanford shall submit to the Department a status report every four years that meets the requirements in Fish and Game Code section 1605(g)(2). Notwithstanding any other measure in this Agreement, the provisions described in Fish and Game Code section 1605(g)(3) shall apply after the Department receives the status report.

General Operation and Construction Measures

34. Nothing in this Agreement shall be interpreted as authorizing the diversion of water or storage of water without a valid basis of right, nor shall any measures in this Agreement be construed as a waiver, forfeiture, abandonment, or estoppel of Stanford's water rights to Los Trancos and San Francisquito Creeks.

35. The Los Trancos and San Francisquito diversion and passage facilities shall be operated in accordance with the measures in this Agreement, Attachments 1-A and 1-B and plans similar to those described in Attachments 4-A, 4-B, and 4-C as approved by the Department.

36. Any maintenance activities that are not described in the Biological Impacts Minimization Plan that must take place in flowing water, or are likely to result in a discharge to flowing water, must be preceded by consultation with the Department to determine if the activity will require an amendment to this Agreement or a new Streambed Alteration Agreement.

37. Except as otherwise described herein and plans developed hereunder, any work described in this Agreement within the bed, bank, or channel of a stream, river, or

lake shall be confined to the period June 15th to October 15th. Revegetation work is not confined to this time period, but must be completed in the same calendar year.

38. Temporary construction fencing shall be erected to designate the construction corridor within the riparian/stream corridor. Temporary construction fencing shall be removed within 30 days of the completion of construction work. Work shall not occur outside of the fenced area without notification and authorization by the Department. If the Department fails to respond within two working days, the activity may proceed as originally notified.

39. Any trees or shrubs removed between March 1st and August 30th must be surveyed by a qualified biologist to determine if the trees or shrubs contain active bird nests. If active nests are present, the vegetation may not be disturbed until the young have fledged. In addition, an appropriate construction buffer must be established in consultation with the Department to avoid disturbance of any nest. Stanford is encouraged to identify between September 30th and February 28th any trees and shrubs that will need to be removed to accommodate the work schedule, and to remove those trees and shrubs immediately.

40. Erosion control measures shall be utilized throughout all phases of operation where sediment runoff from exposed slopes threatens to enter waters of the state. At no time shall silt laden runoff be allowed to enter the stream or directed to where it may enter the stream.

41. Building materials and/or construction equipment shall not be stockpiled or stored where they could be washed into the water or where they will cover aquatic or riparian vegetation.

42. Debris, soil, silt, bark, rubbish, creosote-treated wood, raw cement/concrete or washings thereof, asphalt, paint or other coating material, oil or other petroleum products, or any other substances which could be hazardous to aquatic life, resulting from Project-related activities, shall be prevented from contaminating the soil and/or entering the waters of the state. Any of these materials, placed within or where they may enter a stream or lake, by Stanford or any entity working on behalf of Stanford, shall be removed immediately.

43. Poured concrete shall be excluded from the wetted channel for a period of 30 days after it is poured. During that time, the poured concrete shall be kept moist and runoff from the concrete shall not be allowed to enter a live stream. Commercial sealants (e.g., Deep Seal and Elasto-Deck BT Reservoir Grade) may be applied to the poured concrete surface where difficulty in excluding water flow for a long period may occur. If sealant is used, water shall be excluded from the site until the sealant is dry. This condition applies to any future maintenance operations as well as initial construction.

44. Any equipment or vehicles driven or operated within or adjacent to the stream, river, or lake shall be checked and maintained daily to prevent leaks of materials that if introduced to water could be deleterious to aquatic life, wildlife, or riparian habitat.

45. Any equipment or vehicles driven or operated within or adjacent to the stream, river, or lake shall be cleaned of all external oil, grease, and materials that, if introduced to water, could be deleterious to aquatic life, wildlife, or riparian habitat.

46. Stationary equipment such as motors, pumps, generators, and welders located within or adjacent to a stream, river, or lake shall be positioned over drip pans.

47. If any sensitive species are observed in Project surveys, Stanford shall submit Natural Diversity Data Base ("NDDB") forms to the NDDB for all preconstruction survey data within five working days of the sightings, and provide the Department's Bay Delta Region with copies of the NDDB forms and survey maps.

48. Construction, erosion control, revegetation, and biological mitigation measures shall be carried out as specified in plans to be finalized by Stanford and approved by the Department. If there are any subsequent changes, those changes shall not conflict with the provisions of this Agreement. In the event of any conflict, the provisions in this Agreement shall apply.

Administrative Measures

49. Stanford shall notify the Department within 10 working days of beginning work and within 10 working days of completing any work this Agreement covers. Notification shall be made by telephone to Dave Johnston at 831-466-0234 or by email to Mr. Johnston at djohnston@dfg.ca.gov.

50. In the event that the Project scope, nature, or environmental impact is altered by the imposition of conditions or requirements by any local, state, or federal regulatory agency, Stanford shall notify the Department of any such conditions or requirements that conflict with this Agreement.

51. If Stanford requires more time to complete an authorized activity, Stanford may request Mr. Johnston or, alternatively, the Department's Bay Delta Region (707-944-5520) to extend the work period on a day-to-day basis.

52. A copy of this Agreement shall be provided to Stanford's contractors, subcontractors, and any other persons completing work this Agreement covers, and shall be available at all work sites.

Enforcement

53. Department personnel or its agents may inspect work sites at any time. To the extent practicable, the Department shall provide advance notice to Stanford before Department personnel enter a work site. The Department shall be responsible, and Stanford shall not be responsible, for any injury to persons or property during an inspection arising from the acts and omissions of Department personnel or agents.

54. Stanford agrees to comply with this Agreement and agrees to be solely responsible

for any violations of this Agreement. The Department may suspend or revoke this Agreement at any time if it determines that a violation has occurred. Prior to suspending or revoking this Agreement, the Department shall notify Stanford in writing and shall explain the basis for the proposed suspension or revocation, and Stanford shall be given an opportunity to correct any deficiency before the suspension or revocation takes effect as specified in the Department's notice.

54. Nothing in this Agreement precludes the Department from pursuing an enforcement action against Stanford or any other party instead of or in addition to suspending or revoking the Agreement

55. Nothing in this Agreement limits or otherwise affects the Department's enforcement authority or that of its enforcement personnel.

Other Environmental Laws

56. This Agreement does not relieve Stanford from obtaining any other permits or authorizations that might be required under other federal, state, or local laws or regulations before beginning the activities covered by this Agreement.

57. This Agreement does not relieve Stanford from complying with provisions other than section 1600 *et seq.* in the Fish and Game Code, including, but not limited to, the California Endangered Species Act (Fish & G. Code, § 2050 *et seq.*) sections 5650, 5901, and 5937.

Amendments

58. Stanford shall notify the Department of any modifications it intends to make to the Project. Such modifications may require an amendment or a new notification.

59. This Agreement may be amended at any time, provided the amendment is agreed to in writing by both parties. Mutually-approved amendments shall be attached to and become part of the Agreement. '

Term

60. The term of this Agreement shall be twenty (20) years from the date of last signature below.

61. Stanford may request one extension of the Agreemeht in accordance with Fish and Game Code section 1605(b).

Effective Date

62. This Agreement shall become effective after the Department signs it, which shall be after Stanford's signature and after the Department has completed its required review and approval of the Agreement under CEQA.

Transfer

63. This Agreement may be transferred only with the Department's written consent.

Other Agreements

64. This Agreement supersedes any other agreement or understanding between the Department and Stanford relating to the facilities covered by this Agreement.

Signature

By signing this Agreement, Stanford agrees that this Agreement shall constitute the proposed project for purposes of the Department's required review under CEQA; accepts and agrees to implement the measures herein if the Department executes the Agreement and Stanford proceeds with the Project; and understands that it may not proceed with the Project without a Streambed Alteration Agreement for the Project executed by the Department.

STANFORD UNIVERSITY

Tom W. Zigterman — Date: 7/3/07

Tom W. Zigterman
Associate Director of Utilities

CALIFORNIA DEPARTMENT OF FISH AND GAME

____________________ Date: ____________

Charles Armor
Acting Regional Manager
Bay Delta Region

ATTACHMENT 1 A

Bypass and Diversion Operational Plan for Stanford's Water Diversions from Los Trancos Creek

1) **For Los Trancos Creek the following terms are incorporated into SAA 1600-2005-0735-3**
   a) Stanford will not divert from Los Trancos Creek, under any basis of right, between May 1 and November 30 and all flows must be allowed to bypass.
   b) Diversions at the Los Trancos Creek diversion facility are limited to the period between December 1 and April 30, as follows:
      i) The maximum instantaneous diversion rate is limited to 40 cfs, less the simultaneous rate of flow diverted at the San Francisquito Creek facility.
      ii) Beginning December 1, the instantaneous bypass will not be less than 2 cfs (or natural flow, if less than 2 cfs).
      iii) Beginning January 1, or earlier if the "trigger" event described in paragraph 1.c occurs prior to January 1, the instantaneous bypass flows will not be less than 5 cfs (or natural flow, if less than 5 cfs) when flows upstream of the facility are less than 8 cfs, and will be 8 cfs when flows upstream of the facility are equal to or greater than 8 cfs for two hours.
   c) The "trigger" event for flows described in paragraph 1.b.iii occurs when the Creek has had a mean daily (i.e., calendar day/24 hour) flow above the Los Trancos Creek Diversion facility of 8 cfs or more, any time after October 1.

Time period	Trigger has occurred (see section 1.c above)	Required bypass (cfs)
December	no	2 cfs or the natural inflow
December	yes	5 cfs, or the natural inflow, if flows upstream are < 8 8 cfs if flows upstream are ≥ 8 cfs
January-April	No trigger required	5 cfs, or the natural inflow, if flows upstream are < 8 8 cfs if flows upstream are ≥ 8 cfs

TWZ

ATTACHMENT 1B

Bypass and Diversion Operational Plan for Stanford's Water Diversions from San Francisquito Creek

2) **For San Francisquito Creek the following terms are incorporated into SAA 1600-2005-0735-3**

a) Stanford will not divert from San Francisquito Creek, under any basis of right, from July 1 through November 30.

b) From December 1 through June 30, the instantaneous bypass flows and the maximum instantaneous rate of diversion at the San Francisquito Creek pump station are as set forth in the chart below.[1]

Operational plan for water diversions and bypass flows at the San Francisquito Creek diversion facility.
(Stream flow is discharge at the USGS Gauge near Stanford.)

Stream flow (cfs)	Max Diversion Rate (cfs)	Bypass Flow (cfs)		Stream flow (cfs)	Max Diversion Rate (cfs)	Bypass Flow (cfs)
0-5	0	All flow		24	8	16
6	1	5		25	8	17
7	2	5		26	8	18
8	3	5		27	8	19
9	4	5		28	8	20
10	5	5		29	8	21
11	6	5		30	8	22
12-16	0	All flow		31	8	23
17	1	16		32	8	24
18	2	16		33	8	25
19	3	16		34-40	0[a]	All flow
20	4	16		41-46	4[a]	37-42
21	5	16		47	8	39
22	6	16		48	8	40
23	7	16		>49	8	>41

[a]Maximum instantaneous pumping rate could be increased to 8 cfs over this range of flow if the riffle at Transect 3 is modified and able to successfully pass adult steelhead between flows of 16 and 40 cfs <u>and</u> Bonde Weir is modified to successfully and efficiently pass adult steelhead at flows of 16 to 100 cfs.

c) Consistent with paragraph 2.b, the maximum instantaneous rate of diversion at the San Francisquito Creek pump station (whether to the Felt Lake/campus distribution system, to Lagunita, or to both systems simultaneously) will not exceed 8 cfs, under any basis of right.
   i) The maximum instantaneous rate of diversion to Lagunita will not exceed 4 cfs.
   ii) From December 1 through April 30, Stanford may divert up to 8 cfs at the San Francisquito Creek pump station even if the instantaneous diversion amount is greater than the flows simultaneously bypassed at the Los Trancos Creek diversion facility, provided that the combined instantaneous diversions at the San Francisquito Creek pump station and the Los Trancos Creek diversion facility do not exceed 40 cfs.

[1] If at a later date modifications at downstream barriers occur that would allow changes in bypass flows, Stanford may prepare a new bypass flow plan and submit it to the Department for review and approval as part of a request to amend this Agreement.

TWZ

Note:

Attachments 2 through 9 were bound separately from the executed 1602 Lake and Streambed Alteration Agreement, and are not included.

APPENDIX B
Recommended Best Management Practices for Management of Animal Waste, Compost and Sediment on Creeks

Recommended
Best Management Practices
For Management of Animal Waste,
Compost and Sediment
On Creeks

For
Stanford Management Company
2770 Sand Hill Road
Menlo Park, California 94025

By
Gregory A. House AFM, ARA, CPAg
Lorrain J. Friant AFM
John S. Currey
House Agricultural Consultants
P. O. Box 1615
Davis, California 95617-1615

July 30, 1999

TABLE OF CONTENTS

COUNCIL OF BAY AREA RESOURCE CONSERVATION DISTRICTS, EQUINE FACILITIES ASSISTANCE PROGRAM: HORSE PADDOCKS: DESIGNED AND MANAGED TO PROTECT WATER QUALITY
COUNCIL OF BAY AREA RESOURCE CONSERVATION DISTRICTS, EQUINE FACILITIES ASSISTANCE PROGRAM: DRYLAND PASTURE FOR HORSES
COUNCIL OF BAY AREA RESOURCE CONSERVATION DISTRICTS, EQUINE FACILITIES ASSISTANCE PROGRAM: CONSERVATION MEASURES TO REDUCE NON-POINT SOURCE POLLUTION FROM HORSE FACILITIES
COUNCIL OF BAY AREA RESOURCE CONSERVATION DISTRICTS, EQUINE FACILITIES ASSISTANCE PROGRAM: COMPOSTING HORSE WASTE

Introduction

Maintaining water quality in the creeks of Santa Clara and San Mateo Counties is a high environmental priority. Since rainwater run-off naturally drains into the creeks, land management practices on the lands adjoining the creeks are particularly important to the water quality of the creeks. Irrigation water and wastewater from domestic and recreational activities, if drained into the creeks, are also of concern.

This report is a practical guide to prevent discharges of pollutants into local creeks. This report recommends Best Management Practices (BMP) for the handling of animal waste and other materials generated or stockpiled near watercourses and for the maintenance of unpaved roads adjacent to creeks.

The report was prepared for agricultural tenants on lands owned by Stanford University. Tenants are responsible for ensuring that activities on their leaseholds do not cause polluting discharges to local watercourses. Because each leasehold property is different, it is important that each tenant tailor these recommended practices in a way that is appropriate for his or her individual operations and leasehold characteristics.

Effect of Animal Waste and Compost on Water Quality

As noted by the Council of Bay Area Resource Conservation Districts publication, *Horse Owners Guide to Water Quality Protection*, animal wastes (manure, urine and any material that comes in contact with manure and urine, such as bedding) have biological and chemical properties that can be toxic to fish and other aquatic life if those wastes get into local watercourses. Moreover, any water that comes in contact with compost or animal waste can acquire high levels of dissolved nutrients.

Organic matter and dissolved nutrients are a food source for microorganisms in the water, such as algae and bacteria, stimulating their activity and reproduction. With this extra food, their populations increase rapidly, using dissolved oxygen in the water that would normally be available for other aquatic life. Since all aquatic life depends on the limited amount of dissolved oxygen found in water, the habitat is altered and degraded as dissolved oxygen is less available; fewer species thrive.

Animal waste and compost can also be a source of ammonia, which is toxic to fish in even low concentrations. Salts naturally found in animal waste and compost are also water soluble, mobile, and can increase the salt load of watercourses to levels intolerable to many local species.

Effect of Sediment on Water Quality

Sediment from eroded areas, mud puddles in roads, and dust on roads often can be washed into watercourses during rainstorms. Sediment is detrimental to aquatic life because it can fill pools, smother fish spawning beds, cover food supplies, increase water temperature, block light for aquatic plants, and clog fish gills. It can also bring additional nutrients into the water, as well as toxic substances--hydrocarbons, heavy metals, and pesticides.

Cumulative Effect

Because each of these substances—organic matter, ammonia, salt, and sediments—cause different problems, their cumulative impact can be significant. Discharges of water containing large quantities of these substances can alter the ecology of a watercourse.

What is a Watercourse?

As used in this report, a watercourse refers to all creeks, intermittent streams, and drains, whether natural or man-made.

RECOMMENDED BEST MANAGEMENT PRACTICES

The following recommendations are guidelines for best management practices in the following operations and uses:

- Animal washing
- Horse boarding, pasturing, and training
- Stockpiling animal waste, compost, or nursery-container materials
- Disposing of animal waste
- Land application of manure and compost
- Maintaining unpaved roads adjacent to creeks
- Other sediment producing activities adjacent to creeks

Not all of the suggested practices may apply or be appropriate in all locations. Each tenant should use these guidelines to develop a management plan that is appropriate for their site.

These recommendations are based on numerous sources, listed in the Reference section of this report, as well as our own extensive experience in agricultural management. For easy reference, these recommendations are summarized in Table 1, "Recommended Best Management Practices," of this report. Supplemental equine management literature from the Bay Area Resource Conservation District is also included in Appendix B.

Tenants located in the Town of Portola Valley and the Town of Woodside must also comply with their respective stable ordinances, which are included in Appendix A of this report.

The United States Department of Agriculture Natural Resource Conservation Service (NRCS) is an excellent source of additional literature and recommended practices that meet federal and state soil and water conservation guidelines. The University of California Cooperative Extension also has many publications dealing with animal waste management.

Each county in California has a NRCS office with technical advice available for the actual implementation of these recommendations. Each tenant should contact NRCS and the Regional Water Quality Control Board (RWQCB) to obtain advice. The phone numbers for each office is as follows:

- Santa Clara County NRCS (925) 672-4577
- San Mateo County NRCS (650) 726-4660
- RWQCB (510) 622-2300

Santa Clara County has a special ordinance regulating activities near watercourses. Beginning on July 26, 1983, the Santa Clara Valley Water District (SCVWD) required a permit to (1) construct a structure or perform grading within

50 feet of the banks of a watercourse and (2) to excavate or deposit material on the bank of a watercourse. San Mateo County has similar recommendations, although no formal regulations. Copies of the applicable regulations and recommendations are included in Appendix A of this report.

It is best to schedule major BMP construction projects during the dry season. In addition, tenants should avoid driving heavy equipment within 300 feet of creeks when the soil is saturated with water.

The agricultural leaseholds may have habitat for threatened or endangered species and may contain archaeological resources. Each tenant should contact and obtain approval from Stanford Management Company before performing any of the following activities:

- Locating or relocating stockpiles of any materials, including but not limited to manure, compost, debris, shavings, dirt, or sand
- Grading, trenching, excavating, or other activities that disturb native soil
- Introducing fill soils, base rock, sand, or other foreign materials in or onto the ground
- Moving nursery container boxes within 50 feet of a watercourse

Stanford Management Company will evaluate the proposed activity to avoid impacts on archaeological and/or biological resources. Monitoring may be required.

Animal Washing

Wastewater from animal washing can contain soap, surfactants, pesticides, and other chemicals, as well as urine and organic matter. Tenants should not drain animal wash water directly into watercourses. If animal wash water is commingled with clean run-off water, tenants should not drain any of the water directly into watercourses.

The preferred method to dispose of animal wash water is to drain it into a septic system or dry well. If this method is not possible, the wash water can be directed across a 100-foot vegetated buffer. The buffer should be wide and flat to slow the velocity of the water and permit infiltration into the soil of the buffer. The edges of this buffer should be raised to prevent the wastewater from draining into watercourses. Refer to the section titled "Buffers as Filter Strips", below. If no septic system or dry well exists for animal washing areas, tenants should avoid washing animals during rainstorms.

Arenas and Riding Rings

Arenas and riding rings are fenced or unfenced broad, flat areas for exercising and training horses. Typically they are not vegetated and their surface is sand or mulched soil that is periodically raked or tilled to keep smooth and soft.

Arenas and riding rings do not need to be cleaned of manure provided the manure is periodically incorporated into the soil and at no time could wash into a watercourse. Arenas and riding rings should be located at least 50 feet from any watercourse. This minimum distance is a buffer to protect the water quality of the watercourses. Refer to the section titled "Buffers as Filter Strips", below.

As a BMP, any existing arenas or riding rings should be relocated more than 50 feet from watercourse, or their use should be discontinued unless it is infeasible to do so. If it is not feasible to relocate or discontinue use, then tenants should take steps to prevent run-off.

If less than the recommended buffer width exists, tenants should avoid using uncovered arenas and riding rings during rainstorms and remove all unincorporated manure from them before the rainstorm.

Stalls, Paddocks and Turnouts

As used in this report, a *stall* is the small enclosure in which horses are boarded typically located in a barn. A *paddock* is a small, open-air boarding pen for horses, typically non-grazable, often with a shelter for the horse. A *turnout* is an open-air corral for the horse; its use is temporary and typically horses boarded in stalls are released into the turnout a few hours per day for exercise.

Operators should remove animal waste from all stalls, paddocks, and turnouts daily and take it to the facility's designated stockpile or collection bin (see section titled "Bins and Stockpiles", below). Employees should pay close attention to removal in order to avoid spilling any waste where it might contact watercourses. Operators or animal owners should not dispose of waste in watercourses, or on creek banks.

New construction should be placed at least 50 feet from watercourses. This minimum distance is a buffer to protect the water quality of the watercourses. Refer to the section titled "Buffers as Filter Strips", below.

As a BMP, any existing stalls, paddocks, or turnouts should be relocated more than 50 feet from watercourses, or their use should be discontinued, unless it is infeasible to do so. If it is not feasible to relocate or discontinue use, then tenants should take steps to prevent run-off.

Provided the paddocks, and turnouts are cleaned daily, rain water that falls within these animal confinements can follow natural drainage patterns, but only after passing through an effective buffer. If less than the recommended buffer width exists, tenants should avoid using paddocks and turnouts during rainstorms and make sure all manure is removed before the rainstorm.

Pasture and Equestrian Courses

Pastures are areas with year-round, solid, vegetative ground cover, such as sod or grass. Generally pastures are several acres or more in size where grazing occurs. Equestrian courses are established for the purpose of riding and jumping. Open areas of vegetation that surround an equestrian course are considered pastures although the areas may not be grazed.

Pastures do not need to be cleaned of manure. Provided equestrian courses are surrounded by permanent ground covering vegetation, they do not need to be cleaned of manure. Natural processes will break manure down, and vegetation and soil will filter the nutrients.

Pastures should not be over-stocked. The University of California Cooperative Extension, in its publication *Management of Small Pastures*, recommends a guideline of 1 ½ Animal Units maximum per acre to maintain irrigated pasture in good condition. This recommendation assumes the animals graze the pasture for their food source. The recommended stocking rate may be less than 1 ½ Animal Units per acre for dry, non-irrigated pastures on which animals are given supplemental feed.

Because heavily used feeding areas lack vegetation and manure is likely to accumulate, tenants should not feed animals within 50 feet of a watercourse. If it is not feasible to relocate or discontinue use of such feeding areas, tenants should take precautions to avoid run-off into watercourses and remove manure from these sites daily.

Bins and Stockpiles

Bins and stockpiles are containers and piles used to collect animal waste. Bins may include but not be limited to a covered box, a concrete shed, and trash containers. Stockpiles include but are not limited to piles of animal waste, compost, wood shavings, sand, and soil.

Bins and stockpiles should be located as far as possible and feasible from watercourses, but not less than 150 feet. Distances may vary site by site due to topography, vegetated buffers, physical barriers, and diversions that may exist. Bins and stockpiles should not be located in areas subject to frequent flooding regardless of distance from watercourses.

All drains and surface run-on should be diverted around or away from uncovered bins and stockpiles greater than three cubic yards site regardless of distance. This can be achieved using ditches, berms or drainpipes. Covered bins or stockpiles smaller than three cubic yards can be managed by maintaining the minimum distance with an appropriately vegetated buffer. Refer to the section titled, "Buffers as Filter Strips," below.

Sites of uncovered bins and stockpiles larger than three cubic yards should be designed so that all rain that falls on the collection site is confined within the area or is dispersed in a vegetated filter strip and allowed to infiltrate into the soil. Containment can be achieved by a variety of means, such as visqueen wrapped straw bales, visqueen wrapped straw filter rolls, a berm constructed of compacted soil or other impermeable material, or a lipped concrete enclosure.

Uncovered bin and stockpile sites greater than three cubic yards should have an impermeable surface. California regulations list several types of impermeable surfaces. Soils that contain at least 10% clay and not more than 10% gravel and artificial materials of equivalent permeability are on the list. Concrete slabs are acceptable, and under some circumstances plastic surfaces may also be acceptable.

If the site is less than the recommended distance from watercourses, it should be covered with a plastic tarp during rainstorms or have a roof (UCD Animal Agriculture Research Center, *Technologies and Management Practices for More Efficient Manure Handling*, pages 39-42; and *California Code of Regulations, Section 2562(f)*). In some locations a walled structure may be appropriate.

If the site is less than the recommended distance from watercourses, it may be necessary to create a water storage structure, such as a retention pond or sump. The structure should be sized to contain the 25-year, 24-hour storm frequency (5 to 6 inches per 24-hours according to US Department of Commerce National Oceanic and Atmospheric Administration) and be protected from 100-year flood events. The structure should be lined with impermeable clay, plastic, or concrete. For safety, public access to this structure must be prohibited; a barred covering is suggested as well.

Provided that there is no run-off from the disposal field and percolation of the discharged water to ground water is minimized, applying impacted water to cropped fields or pastures can prevent overflow of water storage structures. Do not apply impacted water within 150 feet of watercourses. Application can be accomplished using a sump pump and pipeline to the discharge field or by pumping the water into a tank truck and spraying it on the discharge field. (UCD Animal Agriculture Research Center, *Technologies and Management Practices for More Efficient Manure Handling*, pages 39-42.)

Off-site Manure Disposal

Removal of animal waste from the property is in most cases the best disposal option. Stockpiles and bins should be removed or emptied before the containment capacity is exceeded or before offensive, obnoxious, or unsanitary conditions develop. Manure collected for removal in the Towns of Portola Valley and Woodside must be removed at least weekly.

Land Application of Manure and Compost

Animal manure and compost can be applied on pastures, reused as a crop nutrient or soil amendment, and reused as a base for trails, courses, and arenas except within 50 feet of watercourses. In all cases the applied materials should not move into watercourses and water should not run off the applied areas into watercourses. Vegetated buffer strips between the applied area and the watercourse is the most reliable method to assure water quality is protected. The section titled "Buffers as Filter Strips", below, discusses buffers in greater detail.

All applications of manure to agricultural fields must be at rates reasonable for the crop, soil, climate, any special local situations, management system, and type of manure. If the manure is wet or liquefied, discharges to disposal fields should not result in any surface run-off.

All land application rates to crop fields should be based on soil sample test results and crop needs. Compost application rates should not exceed 50 dry tons per acre per year (Northeast Regional Agricultural Engineering Service, *On-Farm Composting Handbook*).

Tenants spreading manure or compost on crop fields should incorporate it into the soil immediately to avoid impacts on rain and/or irrigation water that may run off the applied fields. Under no circumstances should manure or compost be spread where the area is subject to frequent flooding regardless of distance from watercourses.

Unpaved Roads Adjacent to Creek

Loose soil from unpaved roads, including driveways, is a potential source of sediment that can wash into watercourses during rainstorms.

Dirt roads should maintain a minimum of an 8- to 10-foot buffer from the top of the creek bank. The buffer should be appropriately vegetated, or run-off should not be allowed to flow directly into the creek. Where the buffer is insufficient and the road slopes towards the creek, run-off should be diverted into a settling basin, such as a pond, a flat-bottomed roadside ditch, or a vegetated filter strip, or the road should be graded away from the creek.

When grading roads, the new road grade should allow for sheet flow, preventing concentration of run-off toward the creek. After grading, the road's surface should be re-compacted with a drum roller or similar device.

Roads with improved surfaces (such as aggregate base) and with minimal loose soil should maintain, at a minimum, a 3- to 4-foot buffer from the top of the creek bank. The buffer should be vegetated, or run-off should be barred from flowing directly into the watercourse.

Periodic inspections of the roads after rainstorms should be made for evidence of erosion and sediment generation. Where erosion gullies are present, eroded areas should be filled in with approved fill material or the gully lined with an erosion blanket and appropriately vegetated.

New roads should be located at a minimum of 50 feet away from any watercourse.

Other Sediment-Producing Activities Adjacent to Creek

Avoid all activities that might produce sediment that may flow into watercourses:

- Operations, such as potting plants or operating heavy farm equipment, should not be conducted within 50 feet of the creek if no berm or vegetation buffer is present.
- Drains and culverts that discharge into creeks should be maintained and cleaned of sediment regularly.

- When watering plants or livestock, avoid over watering and thus generating man-made run-off that could carry sediment into creeks.
- All operations should be performed in compliance with Santa Clara Valley Water District and other local ordinances and under proper guidance from the Stanford Management Company.

Buffers as Filter Strips

One of the best ways to protect water quality of creeks and intermittent streams is to provide distance between the waterway and the activity that may impinge upon water quality. The area created by the distance is commonly called a buffer.

This report recommends certain buffers for particular activities. The width of an appropriate buffer will depend on the purpose and degree of protection needed. The buffer distances are to be measured from the edge of the waterway, which in most situations is well defined by a sharp drop in elevation into the water channel. Tenants wishing to vary from the recommended buffer widths should consult with the Regional Water Quality Control Board (RWQCB) and/or the Santa Clara Valley Water District for specifics.

To obtain greatest benefit from the buffer, it should be vegetated with grass, trees, shrubs or permanent ground cover. The vegetated buffer acts as a filter and a site for removing sediment, organic matter, and other pollutants from run-off and wastewater by deposition, filtration, absorption, adsorption, decomposition, and volatilization.

Appropriate plant species are listed in Table 2. The use of plant materials not on the list requires prior approval of the Stanford Management Company.

Any water that comes in contact with animal waste, compost, or stockpiled materials should be handled according to the recommendations of this report and pass through the vegetated buffer strip before entering any waterways.

Existing riding trails that cross waterways may cross the buffer and waterways if it is safe to do so. Access of horses to the buffer for other purposes should be limited to avoid trampling of vegetation, heavy grazing and damage to waterway banks.

Conclusion

The recommendations of this report are practical measures to protect the water quality of creeks and intermittent streams. Each leasehold is different; each tenant should develop a plan that includes measures appropriate to his or her leasehold. The county Natural Resource Conservation Service gives free technical support for such plans, as well as specific instructions on implementation. The Regional Water Quality Board is also a source of information and advice.

Because many of the leaseholds contain archaeological resources or may contain habitat for threatened or endangered species, tenants should contact Stanford Management Company prior to the activities specifically noted above to insure that these resources are protected and preserved.

TABLES

TABLE 1
RECOMMENDED BEST MANAGEMENT PRACTICES

	Animal Washing	Arenas & Riding Rings	Stalls, Paddocks, & Turnouts	Pasture & Equestrian Courses	Bins & Stockpiles	Off-site Manure Disposal	Land Application of Manure and Compost	Unpaved Roads Adjacent to Creek	Other Sediment Producing Activities
1. Sanitation/Maintenance Practices (see note #1, below)	Do not comingle with rain run-off or drain directly into watercourses. Preferably drain washwater into septic field or dry well; if lacking septic or dry well, maintain extra buffer, see below.	Manure does not have to be removed, but should be incorporated into the soil as needed.	Clean daily.	Do not overstock or overgraze; Maintain permanent vegetation (see note #2, below); If feeding within 50 feet of watercourse clean manure from feeding site daily and prevent run-off.	Divert drains and run-on away from sites of uncovered bins or stockpiles larger than 3 cubic yards; these sites also should have impermeable base and prevent run-off with raised edges, e. g. berms or barriers or disperse to vegetated buffer. If less than 150 buffer, retention pond or sump may be required.	Remove before pile exceeds capacity of containment area or unsanitary conditions develop.Removeal at least every week in Towns of Portola Valley and Woodside.	Acceptable on cropped fields, pastures, areans, equestrian courses, and riding trails (see note #3, below)	Where erosion gullies are present, place erosion blanket and vegetate, or grade road away from watercourse in areas of erosion. When grading roads, grade to allow sheet flow and re-compact road surface. For dirt roads with loose soil that grade toward watercourse and have insufficient vegetation buffer, divert run-off away from watercourse into settling basins (i.e. roadside ditch, pond, etc), or filter strips; or grade away from watercourse.	Operations, such as potting and vehicular use, should not be conducted in the vicinity of the creek if no berm or vegetation buffer is present. Maintain drains and culverts (e.g. clean out sediment) that discharge into creeks Do not over water when irrigating or watering animals.
2. Buffer from Watercourses (creeks, intermittent streams, or drains whether man-made or natural--see nore #4 and #5, below)	50 feet (or 100 feet if no septic field) and appropriately vegetated (see note #6, below).	50 feet and appropriately vegetated (see note #6, below).	50 feet and appropriately vegetated (see note #6, below).	Do not spread manure within 50 feet; Do not feed within 50 feet.	150 feet and appropriately vegetated (see note #6, below).		Do not spread within 50 feet.	For roads with improved surfaces (e.g. aggregate base) and minimal loose soil, 3 to 4 feet from top of creek bank and appropriately vegetated, or create barrier. For dirt roads with potentially loose soil, 8 to 10 feet from top of creek bank and appropriately vegetated, or create barrier. Locate new roads at least 50 feet away from creeks.	Comply with Santa Clara Valley Water District and other local ordinances.
3. Rainstorm Precautions	If no septic field or dry well, avoid use in rainstorm.	If uncovered and less than 50-foot buffer, avoid use of in rainstorms, clean up unincorporated manure.	If possible avoid use of paddocks and turnouts in rainstorms if less than 50-foot buffer.		Cover with roof or tarp during rainstorms, if lacking appropriate buffer.		Surface run-off from application sites must not flow into watercourses	Periodic inspection after rain events for evidence of erosion and sediment generation.	

Notes:
#1: Contact Stanford Management Company for biological and archaeological review prior to earth moving, depositing fill material, relocation of structures, relocation of piles, or relocation of drains.
#2: Pastures by definition have permanent, ground covering vegetation.
#3: Application must not exceed 50 dry tons per acre per year and must be incorporated into soil before rain or irrigation on cropped fields and arenas.
#4: Topography and site conditions may allow variation in the buffers and practices.
#5: A permit is required in Santa Clara County to (1) construct structures or perform grading within 50 feet of the banks of a watercourse or (2) to excavate or deposit materials on banks.
#6: Appropriately vegetated: densely populated grasses/sedges that filter contaminants. See Table 2 for approved list of plants.

Table 2: Approved List of Plants for Vegetated Buffers

- ~~Phragmites sp. (Common reed)~~
- Malacothamnus arcuarus (Northern malacothamnus)
- Chenopodium californicum (California goosefoot)
- Conyza canadensis (Horseweed)
- Apocynum cannabinum (Indian hemp)
- Chlorogalum pomeridianum (Soaproot)
- Calochortus sp. (Mariposa lily)
- Fritillaria lanceolata (Checker lily)
- Trillium chloropetalum (Giant wake robin)
- Eschscholzia califonica (California poppy)

*The use of plant materials not on this list requires the prior approval of the Stanford Management Company.

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